QUALITY STANDARD FOR FROZEN LIMA BEANS— INCLUDING COLOR

FOOD INDUSTRIES

OCTOBER 1939

HOMES OF FAMOUS FOODS . . . KELLOGG'S BREAKFAST FOODS, BATTLE CREEK, MICH.

IN THIS ISSUE: Farmer-Food Manufacturer's Relations, p. 543
Flow and Liquid Level Control, p. 587

McGRAW-HILL PUBLISHING COMPANY, INC.

*Field Report on:**

Stroh's 78 and the ways they save!

Twenty-nine of Stroh Brewery Company's fleet of 72 Aluminum-bodied beer trucks and 6 insulated Aluminum-bodied ice cream trucks. These were built by Proctor-Keefe Body Company, Inc., Detroit. Extra payload per truck: 1500 lbs.

After operating 78 Aluminum-bodied trucks for three years and more, the Stroh Brewery in Detroit knows mighty well what those bodies mean in money. And this is what Stroh's say:

The primary reason for using light, strong Aluminum construction was to get an extra payload of 1500 lbs. per truck, or 30 cases of beer. This extra payload made a cash saving in hauling cost which paid the additional expenditure for Aluminum in the first summer of operation, and was pure bonus thereafter.

But Stroh's count other economies too. In licenses they have saved and are still saving $18.75 per truck annually. They have saved on gasoline, oil, and tires. And they expect a substantial return from the high salvage value of Aluminum when these bodies are finally outmoded.

Would you like to make savings similar to those which Stroh's are now enjoying? Do this: Go to any up-to-date body builder, let him show you what he can accomplish for you by constructing light, strong bodies of Alcoa Aluminum Alloys for your trucks. ALUMINUM COMPANY OF AMERICA, 2152 Gulf Building, Pittsburgh, Pennsylvania.

** This is another advertisement based on reports from our engineers in the field, detailing the experience of truck operators now using bodies or trailers constructed of Alcoa Aluminum. Facts are obtained directly from the operators.*

ALCOA ALUMINUM

FOOD INDUSTRIES

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In THIS *Issue*

• FLOW CONTROL—FOR ENGINEERS

With this issue, Food Industries continues the series "Unit Operations of Food Engineering", twelve articles of which were published in 1936, 1937 and 1938. The current article, "Measurement and Control of Flow in Food Processing" will be found on p. 587. With preceding articles on temperature and pressure measurement and control, it forms part of a group which, when completed, will provide the food engineer with a practical handbook on the selection and application of instruments and controls. We expect to complete publication of these articles in 1940. The current article, as was the case with its predecessors, has been printed as a separate unit, so that food engineers can clip it from the issue for separate filing and reference, if they so desire.

• WHAT DOES A SOLDIER EAT?

War has been brought so forcibly to the attention of everyone these last few weeks, that Food Industries has thought it wise to publish additional information on what the food manufacturers may expect in a war emergency—adding to the information published last June under the title "Food and the National Defense". The present article will be found on page 549. It is by Major Paul P. Logan, Quartermaster Corps, U. S. Army, and tells how the Army is fed in war time. It also indicates some of the changes in manufacturing procedure that war would make necessary in the food industries.

• BACK TO THE FARM

Just a year ago, Food Industries inaugurated its series of articles on public relations with a special section defining just what good public relations in the food industries is, and suggesting how the food manufacturer might set out to improve his public relations. One of the things that we then said should be done, is to improve relations between food manufacturers and the farmers who supply their raw materials. This has been done very successfully by Swift & Co., and the way they did it, as told by Herbert E. Fleming, will be found on page 543. The method outlined is one that can be adapted to many other branches of food manufacture.

• WHAT IS QUALITY IN FROZEN LIMAS?

Agricultural Marketing Service, U. S. Department of Agriculture, has just proposed a standard defining quality grades for frozen lima beans. This is reproduced on page 554 A of this issue of Food Industries, with an accurate reproduction of the color standard set by the Government.

In FORTHCOMING *Issues*

• WHY GO TO THE CHEM SHOW?

Because it is not only an exhibit of equipment for chemical engineers, but also for food engineers. Filtering, drying, evaporating, distilling, pumping, conveying, heating equipment and many other things used in food processing plants will be shown by several hundred exhibitors. To examine this equipment and talk to the men who make it, is a liberal education. All food engineers who can possibly get to the Grand Central Palace in New York City during the week of Dec. 4, should be sure to do so. And, when you get there, do not fail to call at Food Industries' booth.

• BUT MAYBE YOU CAN'T GO

Well, then, the next best thing will be to read Food Industries for December—it will do much to bring the Show to your own office.

In the first place, there will be a "Preview" of the Show. That will tell you who will exhibit equipment that is important to food manufacturers, and just what they will exhibit. Also, there will be a "Get Me These Catalogs" section, in which will be listed the manufacturer's bulletins which describe the equipment shown at the show, with a convenient order card. Mail this order card to Food Industries, with the desired bulletins marked, and we will have the publications sent to you as promptly as possible.

• AND IN ADDITION

As a special feature, Food Industries will publish in December a 16-page discussion of the drying of food products and ingredients. This will discuss the equipment available for the purpose and the applications in which this equipment gives good results. The study was made by Francis Rosseau, a food engineer with long experience in drying food products, who developed the well known process for drying citrus cannery wastes.

• ANOTHER REMINDER

Attention is called to the fact that extra copies of the standard for quality grades of frozen lima beans, appearing in this issue, as well as copies of previously published standards for frozen peas can be secured at 50 cents each to subscribers or 75 cents each to non-subscribers. The standard for canned tomatoes is available at 35 cents each to subscribers and 50 cents each to non-subscribers.

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The Talk of the Industry

» IT IS HOPED that you were not seriously inconvenienced by being deprived of comment in these pages in September on the outbreak of the Second World War. Events were occurring so rapidly during the last days of August that even a daily newspaper could hardly keep up with them, let alone a monthly magazine.

» ONCE AGAIN the government seems to have stepped into a hot spot by failing to confer adequately and privately with many manufacturers of preserves and jams before proposing a standard of identity under the new food law.

» BY MIDAFTERNOON of the first day of the hearing on preserve standards, long before J. W. Sale had concluded presenting the government side, most manufacturers were asking each other "If we are going to be required to put everything on the label what is the use of a standard of identity? And what is the use of holding a hearing at all?"

» NEWS from the sugar battle. A new contestant entered the contest between sucrose and dextrose at the hearing on standards of identity for preserves. The newcomer is the manufacturer of partially inverted sucrose sirups and is doing some heavy slugging. Reason: the proposed definition limits ash content of such sirups to 0.05 per cent. Pretty soon it will be a battle royal.

» ONE BENEFICIAL EFFECT of the Russo-German pact has been that of silencing one of our most persistent, though genial, critics. To him, FOOD INDUSTRIES has always been conservative to the point of being a Bourbon reactionary. Asked, after the announcement of the Communist-Nazi Pact, how he now defined social minded liberality, he politely consigned us to the nether regions. Which is a sufficient vindication.

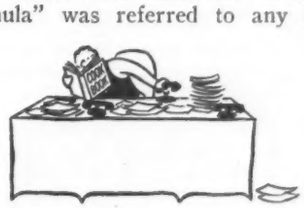
» CHINESE who call on American business houses should carry and submit indisputable credentials as to their nationality. Recently one of them was mistaken by a reception clerk for a Japanese and was refused admittance or even an opportunity to talk to anyone in authority.

» EFFORTS BY SECRETARY WALLACE to subsidize the increased domestic consumption of surplus foods as a means of disposing of food crop surpluses seem destined to failure. The great difficulty from the food standpoint is that the demand is not for the crop in which surpluses are really embarrassing such as wheat, but for the more palatable foods such as meats, milk, fruits and vegetables. Very few persons would eat more bread if they could get it. In fact, certain agricultural economists believe that the records of consumption can be interpreted to mean that people eat less bread in prosperous times.

Mere substitution of more meat, milk, fruits and green vegetables to replace wheat would not help the wheat surplus situation very much—however desirable it might be from the dietary standpoint. On the other hand, such substitution of higher priced foods might mean more farm income for the country as a whole. But it does not appear that Secretary Wallace's proposals will actually do anything to alleviate the burdensome crop surpluses. His proposals appear to stem from idealistic thinking rather than a practical knowledge of the facts.

» TO BE DISDAINFUL of household cook-book formulas, is to overlook the accumulated experience of humanity covering many centuries.

A reader who asked for "a bread formula" was referred to any cook book. But he felt that this was not adequate information.



To those who feel that the housewife's cook book is too easy and simple to be of real industrial value it should be known that many a famous food was started from such a humble

source. To illustrate: The original formula of Libby's Corned Beef Hash was taken bodily from an old cook book in the kitchen of Mrs. Charles H. Emery, when her husband was superintendent of Libby's only plant about forty or fifty years ago.

A more recent incident is that of Mrs. Margaret Rudkin of Fairfield, Conn., who started baking bread commercially about August 15, 1937, and used an old family recipe. Her bread sells at retail 25 cents per 24-ounce loaf, and in exactly two years her sales volume has climbed from zero to 22,000 loaves per week.

Cook books are often excellent sources of formulas, provided that the product is one that can be made in the home as well as the factory.

Prices Move Up

OLD HCL is with us again. Food costs soar. Price advances are front page news. Housewives protest. The Cabinet meets. The President is watching. Secretary Wallace seems to approve.

Everywhere the women are talking excitedly about it—and acting. Only their actions are sure to drive prices higher. Sugar became suddenly scarce. Women stocked up. One in Delaware bought the first 100-lb. sack she ever bought. Another in Annapolis, Md., had to shop in a number of stores before she could assemble a hundred pounds.

So far, it's only a flurry but what about food manufacturers? One, of our acquaintance, needed 50,000 lb. of sugar in two days and found several refineries sold out. He finally covered his urgent needs at a 2 cent advance.

Flour mills were reported by *Northwestern Miller* to have been selling flour during the first week of the war at the rate of 165 per cent of their manufacturing capacity.

Even the lowly pea bean doubled in price inside the first week of the war.

Many manufacturers are withdrawing all prices. Nobody knows where they stand. And all this takes place in the face of the burdensome surpluses that existed in August.

What does it mean? Are we to have a war time boom of major proportions? Let us hope that HCL can be held in check, for increased costs of living will surely bring labor troubles in their wake that will make the strikes of the First World War seem trivial.

To nearly everyone, the current situation appears to be just the reverse of what occurred in 1914. But FOOD INDUSTRIES is inclined to a different explanation. We believe that the current events are merely 1914–16 at a vastly accelerated pace. People in the United States seem to believe the old Pillsbury slogan "Eventually, why not *now?*" And are taking the necessary steps to bring the future to the present.

Our opinion is that there will be a reaction unless the export demand increases markedly. Our surpluses are still in existence. If prices jump it is only because of frantic consumer buying.

Long War Ahead

A FIVE-YEAR WAR, into which the United States may be forced—possibly within six months, is the estimate on which every Washington activity is based. It might be wise for the food industry to follow suit—just in case—on all future plans, expansion, buying of foodstuffs and materials, everything.

As high government officials put it, the President hopes to keep the U.S. out of war, but the government agencies are getting ready just as though that hope would be unfulfilled.

There is nothing sentimental about it. It is the government's duty to be prepared. Mental partisanship is not the reason for the government planning.

The reason is simply that the Administration believes that possibly desperate Nazi policies may force the U.S. into the war, regardless of the earnest desire of an overwhelming majority of the American people to stay out. So the plan is to get ready.

There is the recruiting of the Army and Navy up to greater strength than Congress contemplated—and dependence on deficiency appropriations when Congress meets, either in extra session or in January—to finance Army and Navy payrolls for the last six months of the fiscal year, from January 1 to July 1.

There is the reconditioning of 116 World War destroyers, whose func-

Hors d'Oeuvres

• De Soto brought the first bacon home to America. In 1539 he landed near Tampa Bay with 300 head of hogs. He took these porkers on his famous 2,000-mile march to the Mississippi. En route he lost 400, but arrived with 700. If you question these mathematics, you don't know your porkers.

• *The doughnut industry has a good slogan for young hopefuls: "As you go through life, no matter what your goal, keep your eye upon the doughnut and not upon the hole."*

• Challenged by an officer in General Washington's army to mix a drink he had never tasted before, barmaid Betsy Flanagan, White Plains, N. Y., prepared the first cocktail. She put in a dash of everything on the shelves, garnished it with a cherry and a slice of orange. As a final flourish she stirred it with a feather from a rooster's tail. Next morning the officer's throat probably was full of "feathers."

• *The white potato is no more fattening than a large apple or an orange, says the New York State College of Home Economics. Maybe so. But there are lots of waistlines in the country which could eloquently argue that point.*

• National Pickle Packers Association has launched a research program to discover the dietetic value of the pickle. In a couple of years you may be eating pickles to grow hair on your chest or something.

• *Miss Americow has been crowned at the New York World's Fair. No, she's not a fat and forty female. She's the best of the Borden bovines.*

• "Hazen's Folly" they called it in 1864 when Chester Hazen opened the first cheese factory in Wisconsin. Since then the state's cheese industry has grown until it produces over half the United States output. Many are the difficulties in moving this large supply to market at a reasonable price. Maybe they were right in 1864.

• *From figures on the amount of food purchased by the Army, one would gather that the soldier's meal is a long way from being a mess.*

• Do you know:—Who puts the holes in Swiss cheese? *Lactobacillus bulgaricus.* And all the time we thought they were shot in by the Swiss navy . . . Why the tomato is a vegetable instead of a fruit as Nature made it? Because the Supreme Court said so in 1893 . . . Where johnny cake originated? The Pilgrims made it from cornmeal mixed with water and baked on a hot stone. It was then "journey cake" because no man ever left the settlement without it.

• *Salmon fishing has been going to the wolves in Canada. Not content to wait at the door, the wolves lie along shallows in the streams and make a lightning-like grab at the first salmon to come along.*

F.K.L.

tion, it is officially stated, will be to patrol a strip of the Atlantic from Maine to Panama and extending in the direction of Europe for "several hundred miles."

Just another Athenia or two, Administration leaders figure, and it may be 1917 all over again. But this time, the Administration is determined, America will be ready. Not with an expeditionary force—there is no planning for that yet—but so American aid to Britain and France can be made effectual without the unconscionable delay of 1917, if we are forced in.

This sounds most pessimistic, but it is well to keep that five year idea in mind. It is the cold judgment, after long study, of the Administration's Army, Navy and aviation experts, with every conceivable element figured. And don't forget that the five years is calculated on the basis of American participation after about six months.

Cost of Raw Materials

CONDITIONS in Europe will greatly disrupt commodity movements. Those which food makers must buy in "world markets" will be most disturbed. Commodities like wheat and corn, now largely in surplus, are likely to be advanced in price, especially by any long war. But the food manufacturers will do themselves the greatest harm by rushing into the market in any attempt to build up unusual reserves of these goods. The surpluses are great, the prices are likely to be reasonably stable over a considerable period. Panicky buying can only become costly to the buyers.

Far more important to the food manufacturers at this time is the problem of those minor food materials which come from abroad. Every manufacturer should look over his formulas now, with this in mind. He should think about each material he buys, clear back to the primary sources. He should study with his normal suppliers the questions of possible interruption of flow of those goods which originally come from abroad. The leading spice men, outstanding leaders of the chocolate and cocoa industry, and others in like position will not find it difficult to tell the manufacturers of foods what to expect about each such important commodity in which they are both interested.

It is to be hoped that consultation between food manufacturers and those who supply these kinds of goods can prevent both uncertainty as to supply and any needless disturbance of the markets. It may be that some food formulas will ultimately have to be changed a bit. But there will be time enough to accomplish that, since American stocks of practically all classes of goods are abundant. Sensible planning now is desirable. But any panic or runaway markets are silly. Fortunately they are also needless.

Food Exports Affected by War

HOW MOBILIZATION would affect the food consumption of the United States was carefully analyzed in June, FOOD INDUSTRIES. In particular, your attention is directed to the table on page 310 which shows the percentage increase or decrease of consumption of the principle food categories as a result of mobilization alone. The table is repeated here in case you missed it.

Though the army and navy rations of foreign nations differ considerably from those of the United States, the national food demands will increase or decrease in somewhat the same ratios for two important reasons.

1. Military forces consume more and waste more food than corresponding numbers of men in civil life.

2. Armies in the field cannot carry refrigeration with them. Indeed, their food must be brought up every day from distances far in the rear.

Though it is possible roughly to compute the export possibilities from the foregoing, any such planning must also take into the reckoning the workings of any neutrality laws of the United States.

Changes in Food Supply Necessary to Feed The United States in Time of War

Food	Tons Needed for 130,000,000 Civilians	War Time Needs in Tons			Total War Needs in Tons	Change + or −	
		125,700,000 Civilians	Navy of 300,000 Men	Army of 4,000,000 Men		Tons	%
Cereal Products	14,105,000	13,640,000	46,500	658,000	14,344,500	+239,500	+1.7
Potatoes	10,660,000	10,308,000	34,200	456,000	10,798,200	+138,200	+1.3
Sugars	7,150,000	6,914,000	17,100	250,000	7,181,100	+31,100	+0.4
Dairy Products: Milk, fluid	21,320,000	20,616,000	27,450	366,000	21,009,450	−310,550	−1.5
Cheese, etc.	1,820,000	1,750,000	1,800	58,000	1,809,800	−11,200	−0.6
Butter	1,105,000	1,069,000	5,550	92,000	1,166,550	+61,550	+5.5
Fruits	12,480,000	12,068,000	34,200	214,000	12,316,200	−163,800	−1.3
Vegetables	9,815,000	9,491,000	44,550	510,000	10,045,550	+230,550	+2.3
Lean Meats and Fish	8,580,000	8,297,000	68,400	730,000	9,095,400	+515,400	+6.0
Eggs	1,950,000	1,886,000	8,250	92,000	1,986,250	+36,250	+1.9
Beans, Nuts, etc.	910,000	888,000	1,650	22,000	911,650	+1,650	+0.2
Fats (except butter)	2,990,000	2,891,000	5,550	150,000	3,046,550	+56,550	+1.9
Coffee, etc.	1,105,000	1,069,000	2,550	34,000	1,105,550	+550	.....
Totals	93,990,000	90,887,000	297,750	3,632,000	94,816,750	.....	.....

The Little Fellow Is Hit

COMPLAINTS are coming to Washington about the secondary effects of certain agricultural control measures. Important complainants are small processers, like small wheat flour millers. They find the details of doing business under present elaborate regulations very expensive, at times almost prohibitive.

This is not surprising. Uncle Sam now imposes so many restrictions as to make it almost necessary for the small miller to have a big bookkeeping and ritual-performing staff simply to meet the Federal regulations. This extra burden is almost as great on a carload of wheat as it would be on a trainload.

Many little establishments meeting this kind of problem should advise their congressmen as to the root of their present difficulties. Congressmen can, and undoubtedly will, be anxious to have the Washington machinery simplified wherever possible. Certainly the administration is not anxious to hurt the little fellow needlessly. All of the official thinking is in the other direction.

Those food plant executives that can make specific suggestions for simplifying government relations should take the initiative in bringing their ideas to proper public officials. Oftentimes a simpler plan may work just as well as the present elaborate ones. The whole industry, not only the small plant executive, should study the problem from this point of view, and seek, even demand, relief from burdensome detail that does no good.

Citrus Fruits vs Synthetic Vitamin C

WHAT THE WAR ABROAD will mean to the food manufacturer of the United States will be the subject of much comment in the future. As a starter, our readers should be informed that the British Low Temperature Research Station has ascertained that 150,000,000 cubic feet of shipping were required to bring 400 tons of natural indispensable vitamin C to the United Kingdom in the form of fruits, especially oranges.

It was stated that all this shipping capacity could be released for other purposes in war time by substitution of synthetic vitamin C in the public's diet. Should Britain become hard pressed, it can be foreseen that Florida, Texas, Arizona and California producers of citrus fruits may find themselves suddenly deprived of their export market.

Processors of citrus fruits should, therefore, examine this possibility with the utmost care before committing themselves to purchasing contracts.

Citrus fruit production, already over-developed in the case of grapefruit through the gigantic expansion of Texas plantings, is even now the source of many an anxious consultation. When, as and if Britain imposes restriction on importations of citrus fruits, the existing problems will be greatly aggravated.

New Food Taxes

POSSIBLY the European conflict may prevent the imposition of new taxes on the raw materials for food manufacture. If prices are advanced and stabilized at such levels that further agricultural relief is not imperative, then the industry may escape a re-establishment of processing taxes. To be sure, the new form of levy was not to be called by that old obnoxious name. The new scheme contemplated a "certificate plan," but the effect would have been the same on costs.

In general, it is not expected that the Administration or Congress will think that new war levies are necessary unless the United States is actually drawn into the conflict. Every tax expert knows that the present tax law will raise a stupendous sum of money, may even balance the budget, if we should have renewed business activity with fair profits. The enlarged volume of business, inevitable as a result of European war conditions, may achieve this and may prevent *general* new taxes.

But the food manufacturer may still be singled out for taxes on raw materials. If so, the certificate plan may provide that he will have to buy from the government certain certificates when he is ready to sell goods made from agricultural raw materials. Agriculture may not call this a processing tax, but it has all of the same characteristics except that the levy comes after manufacturing (before sale of products) instead of before processing.

More Controlled Temperatures Needed

KEEPING FOOD FRESH for the consumer is a difficult job for the factory management. Yet this is increasingly a job of production in any division of the food industries which is not to lag behind in the competition for favor with Mr. and Mrs. Householder. A bit of collaboration clear through to the kitchen is needed.

Not long ago it was pointed out in these columns that "keep the bread in the ice box" was a good motto for the baker to use with his customers during hot, humid weather when mold troubles might otherwise occur. Now we find that some of the ladies are telling each other that they should "keep the coffee in the refrigerator"! And this is not as foolish as it sounds.

Other divisions of manufacture outside the food business are making tremendous use of refrigerated storage. One great manufacturer making a semi-perishable commodity which sells seasonally, but is manufactured at a uniform rate through the year, puts a large part of his production into refrigerated warehouses during the period when sales are low though production is at full scale. One would not be much more likely to think of putting a typewriter in the ice box than to put this particular commodity into such cooled storage. But this company, which prefers not to be mentioned by name or commodity, finds this practice worth while.

A great many foods that are not refrigerated today are far more perishable in fact than this commodity to which we have referred. These foods should be kept under controlled conditions of temperature, and often under conditions of controlled humidity also. The condition of the delivered foods would be very much improved if they were.

The costs of distribution are already very high in the food business. Most executives would dread the thought that they must refrigerate more of their production, or keep it in cold storage for longer periods than they now do. But the over-all cost as delivered to the consumer, *in satisfactory condition,* may be less with the use of more refrigeration. And then if we can get Mrs. Housewife to put the semi-perishables in the refrigerator, we will be sure that even the last portion of the goods will be palatable, instead of just barely passable when served.

In all of this one must remember that the really palatable goods are the ones on which we get repeat orders, and big profits.

New Developments in Cheese Packaging

PACKAGED CHEESE today is largely processed or pasteurized cheese, but a new form of cheese is beginning to appear on the market in small amounts. This is packaged, sliced, unprocessed cheddar in 12-oz. and 2-lb. cans from Portland, Ore., and 8-oz. prints in 5-lb. cans from Bellingham, Wash. Also sliced Swiss cheese in 5-lb. cans from Sugar Creek, Ohio. Retail selling prices in Eastern cities vary, depending on the size of the container. We are informed that the cheddar cheese in 12-oz. cans retails for 50 cents per 12-oz. can, 8-oz. prints in 5-lb. cans at 32 to 34 cents per lb., and the sliced Swiss in 5-lb. cans sells for 60 cents per lb. Production cost of 8-oz. prints of cheddar cheese packed in 5-lb. cans is said to be 5 to 6 cents per lb. over the cost of daisies.

Though these selling prices are high, the point is that the cheese in the new form seems to be gaining public acceptance. Cheese from Bellingham, Wash., and Portland, Ore., must take an awful beating on rail freight rates for there is no refrigerated steamship service in less than car lots to the Eastern Seaboard. In spite of this handicap it is being distributed on the East Coast and the sliced Swiss Cheese, packed in Ohio, is gaining in popularity in chain drug stores and sandwich shops on sheer merit.

The probable trend suggested by the foregoing is that the bulk tin can will be used in cheese distribution and that unprocessed cured cheese will be sold more extensively because it will be available in package form. Retail purchasers will not see the cans at all, when the cheese is packed in small segments in 5 or 10-lb. can, except, possible, at the store. When purchased in the 12-oz. or 2-lb. can, the cheese is delivered to the home in this same container.

This new technic in cheese packaging and curing, developed by the Bureau of Dairy Industry, U. S. Department of Agriculture, is worthy of close study by those who produce or handle cheese in any form.

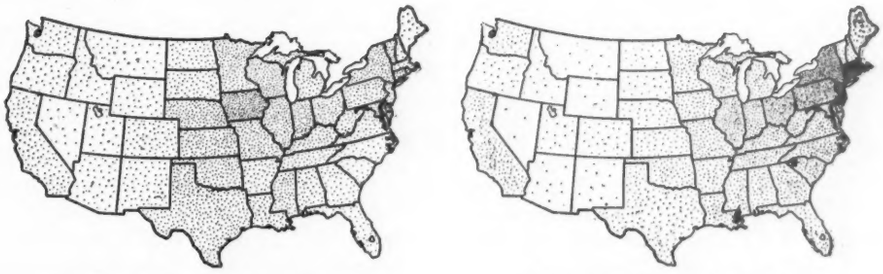
Help the Other Fellow Understand YOUR Problems

Relations Between Farmers and Food Manufacturers Improved by Interchange of Information

By HERBERT E. FLEMING
Chicago, Ill.

▶***There is no more important category of public relations in the food industries than that which deals with the relations between the food manufacturer and his source of raw materials—the farmers. This article tells how Swift & Co. gives livestock producers a better understanding of how livestock and wholesale and retail meat prices are made in the packing industry, by means of "producer trips." The method used and the results obtained are worthy of the attention of***

All Food Manufacturers



WHERE CATTLE ARE PRODUCED **WHERE BEEF IS CONSUMED**

Meat producers and meat consumers tend to be geographically separated, hence one group lacks understanding of the other's problems.

ALL told, Swift & Co. carries on twelve lines of activity for promoting understanding of the meat packing business by farmer producers. But the most unique and far-reaching, as it appears to an independent observer, is the highly developed "producer trip."

Each of these producer trips is a circle tour. On it, a group of fifteen to twenty producers or feeders of cattle or lambs has two weeks behind the scenes at the Union Stock Yards in Chicago, and at branch houses selling Swift & Co. products in Boston, New York, Philadelphia, Baltimore and Washington. For example, during October, range sheep producers, selected by their associations, will take one of these trips as guests of the company. The men in each group look and listen in on all phases of buying, slaughtering, grading and selling. They ask questions. The Swift men, in all ranks of the business, are under absolute instructions to answer every question fully, if they have the answer. Finally, the answer must be found.

Thus these trips overcome misunderstanding, especially the suspicion that there is collusion among the national meat packers as to prices paid for livestock and that the meat packers determine the prices of both livestock and meats.

"Farmers producing cattle, lambs, or hogs want the highest possible prices, while retailers and consumers want the lower prices," said John Holmes, president of Swift & Co., when interviewed recently by the writer. "Two-thirds of the livestock is produced west of the Mississippi, while two-thirds of the consumers live east of the Mississippi. The average distance between the places where meat animals are raised and those where meat is eaten is 1,000 miles. The Swift meat packers organization for buying, processing, and distribution is between.

"As an industry, producers, meat packers, and retailers—we three—are one. The meat packer must have right relations with all the people concerned. Our philosophy of business in Swift & Co. is that, while we perform a public service and have a real regard for our social responsibility, we are a private enterprise conducting an honest business to make an honest profit. Our rate of profit, per dollar of sales, per pound of products or per dollar of investment, is very low.

"We of Swift & Co. do not attempt to advise the livestock producer on what types of beef, lamb, or pork to raise or when to ship. The meat packers, Swift and over 1,000 other companies, provide a daily cash market, to take whatever the producers send whenever they ship. We process it, and by means of refrigerator cars, first promoted for this industry by the late Gustavus F. Swift, Sr., we move the dressed meat to the retailers.

"It is up to us to help the producers

know about and understand our business. They are beginning to know that we cannot raise prices paid to them beyond the figures imposed each day by competition and the law of supply and demand. For seven years now, we have been bringing representative groups of farmers into our Chicago plant and then taking them to our customers in the east, their customers once removed."

For details, Mr. Holmes referred the interviewer to F. M. Simpson, head of Swift's "Agricultural Research," the originator and conductor of the producer trips. He is regarded as "the 'dirt farmer'" of the Swift organization. He was raised on a farm near Vienna in southern Illinois, worked on middlewest farms summers, was a cow hand on ranges for two winters and three summers for a Montana cattle company, taught marketing of livestock and meats at the University of Illinois, served at Washington in the Department of Agriculture, went back to the cattle company buying steers at Denver, and moved to Chicago, where for the Illinois Agricultural Association he helped to plan and put in operation cooperative commission companies. So when he joined Swift's in 1925 he took to its "Agricultural Research" a down-to-the-ground appreciation of the point of view of the farmers.

It appears, in fact, that when Mr. Simpson took a position in the Swift organization, it was with fingers crossed. He was thoroughly familiar with the attitudes or suspicions held by certain producers, among others: that the meat packers have a monopoly; that their profits are too large; that they keep two sets of books. His conversion to the idea that it would pay Swift's to take representative producers right into the vital daily scenes of the business, and there to tell them all about it, came from his own experiences during several years in contacts within the organization. It fell to his lot to answer the inquiries that came from producers. To get the answers he went to the desks of the men who gave orders to the buyers, went out into the pens with the buyers, talked to the production superintendents, and attended foremen's training classes.

One day in the summer of 1932, after some western sheep men had been in, complaining that they couldn't understand why prices had gone down, the idea popped that they would if they could go around as he did. He submitted the idea to William B. Traynor, vice-president, treasurer and director, who accepted it and sent it on up to the board of directors. Mr. Simpson was called before the board, outlined the plan for the producer trips, and stressed the point that officers, superintendents, buyers, branch managers, and salesmen would have to be completely frank in answering questions put by guests. The board so ordered.

In the seven years since then, twenty-one of these producer trips, listed in the accompanying table, have been conducted by Swift & Co. More are planned. They are a fixture in its program, tops in technique for cultivating good relations with farmers and producers.

The trips are arranged to fit in with the times of marketing of the different kinds of livestock. They are scheduled for the range lamb producers in early October, for the range cattle men in early November, for the lamb feeders in February, and for the cattle feeders in the spring.

The guests for the trips are selected by officers of the associations of the respective types of livestock producers or feeders. Those going on the range cattle producers' trip, for example, are chosen by officers of the American National Live Stock Association and various state associations. Newly elected officers usually take the trip themselves. This method of selection has the result that leaders among livestock producers and their organizations are the ones to go.

The invitations to the associations are brief letters, enclosing one-page typed bulletins. That enclosed, for example, for the lamb feeders' trip in February and March this year, aside from its paragraphs about travel arrangements, said in part: "We have always felt that the exchange of ideas between producers and packers is helpful to the livestock and meat industry. We want to know your problems and we want you to know ours. To that end we believe it would be mutually advantageous if a group of lamb feeders would visit our plants and sales offices."

All details are carefully worked out. Each producer taking the trip is given a mimeographed schedule, showing from hour to hour where to go.

Suppose we follow, in the main, those who took one of the cattle feeders' trips. On the afternoon of the first day, a Sunday, they met at a Chicago downtown hotel with Swift officials and discussed the program for the tour. They were scheduled to keep good farm hours. Almost daily they were up and through breakfast in time to start for the Swift establishment at 7 a.m.

On Monday, the second day, at 7:30 a.m., when buying operations begin at the Union Stock Yards, the entire group gathered in the office of Paul C. Smith, the Swift vice-president in charge of buying and selling beef, lamb and veal. They listened, some on telephone extensions, while he received reports from the branch houses on what they were selling and figures from twelve markets on receipts of livestock. They heard him dictate instructions to buyers, given on a dressed beef basis, for example: "Receipts continue heavy. Eastern outlets badly clogged. Try to buy 25 cents lower dressed than close of last week. If you cannot do this, buy only moderate supply."

Then at 9 o'clock, half of the guests went out into the yards, mounted horses, and rode with the buyers, watching them in their bids to the commission men handling sales of producers' cattle. They saw them competing with buyers representing several hundred meat packers. They identified two carloads of cattle bought by noon, one to be slaughtered in Chicago, the other to be shipped alive to New York.

During the same forenoon, the other half of the group stayed in the offices, watching operations, including instructions from the "loading desk" to Sioux City, Kansas City, and St. Joseph on what to ship to Chicago.

By noon they all were ready to eat.

WHERE LAMBS ARE PRODUCED

WHERE LAMB IS CONSUMED

Lamb producers and consumers are even farther apart than cattle raisers and beef eaters.

Twenty-one trips for producers conducted by Swift & Co.

Kind of Trip	Number of Trips	Dates of Trips	Number Participants	
Range Sheep Trips	7	Oct. 16–28, 1932	11	
		Oct. 15–28, 1933	12	
		Oct. 7–20, 1934	12	
		Oct. 6–19, 1935	11	
		Sept. 27–Oct. 10, 1936	11	
		Sept. 27–Oct. 9, 1937	12	
		Oct. 2–15, 1938	16	85
Range Cattle Trips	6	Dec. 3–15, 1933	19	
		Nov. 4–17, 1934	19	
		Nov. 3–19, 1935	20	
		Nov. 8–21, 1936	18	
		Oct. 31–Nov. 13, 1937	19	
		Oct. 31–Nov. 12, 1938	20	115
Cattle Feeders' Trips	3	May 2–14, 1937	12	
		April 13–16, 1938	17	
		April 9–22, 1939	20	49
Lamb Feeders' Trips	5	Mar. 24–Apr. 4, 1935	7	
		Feb. 9–22, 1936	11	
		Feb. 14–27, 1937	13	
		Feb. 20–Mar. 5, 1938	17	
		Feb. 26–Mar. 11, 1939	17	65
Totals	21			314

On these trips the mid-day meal is "dinner" not lunch. At this Monday dinner, in the restaurant in the Swift general office building, they met four of the five Swifts on the company's board of directors: Charles H., chairman; G. F., vice-chairman; Harold H., vice-chairman; and Louis F., Jr., in charge of veal buying—the first three being sons and the fourth a grandson of the company's founder.

That afternoon the entire group of producers visited the plant and watched the cattle they had seen bought that morning dressed on the killing floor.

On Tuesday, the third day of the tour, the Monday experiences were repeated with halves of the group reversed for following the buying in the pens and the office work. In the afternoon they all checked up on the grading of the cattle they had seen killed on Monday, final grading being possible then because the animal heat had been chilled out. They compared the graded dressed beef with the estimate of the day before, and were told of the credit allowed for by-products per head.

Arriving in Boston on Wednesday, the fourth day, they devoted the afternoon to observing slaughtering methods and handling of byproducts in a smaller plant. In Boston, they met George H. Swift, eastern representative, another son of the founder.

Since fish competes with meat, the trippers all went at 7 o'clock on the morning of Thursday, the fifth day, to the Boston fish pier. There, incoming boat loads of fish are auctioned. They noted that while a catch of swordfish was being unloaded from one ship at 20 cents per pound another boat came alongside and its load was offered and taken at 12 cents. They asked the fish men, "How much fish comes into the port of Boston in a year?" The answer was, "Three hundred million pounds."

During the remainder of that day, the producers went to branch wholesale houses and watched retailers bargaining with Swift salesmen. As one remarked afterwards, "It seemed strange to see the meat packer salesmen arguing with the retailers about prices." Later they visited a warehouse of a food-store chain and saw how it makes up cuts, expressing surprise at the high quality in its coolers and at consumer preferences in New England. The forenoon of Friday, the sixth day of the tour, was devoted to going out with salesmen from Lynn to Brockton calling on independent retailers, leaving the afternoon free to travel.

In New York City, on Saturday morning, the seventh day of the trip, the producers examined the beef they had seen slaughtered in Chicago on Monday. This was the group's first introduction to sales practices in the United States' largest meat consuming market—New York City.

After a day of rest, individual church-going and seeing sights on Sunday, their eighth day on tour, they set out on Monday morning, the ninth day, to New York branch houses, one to each branch, to observe wholesaling. Here they learned that in this metropolis there is a faster market than elsewhere and that the meat is "ribbed down" differently.

Furthermore, approximately 50 per cent of the beef sold in New York is for the Kosher trade. According to the rules of the orthodox Jewish rabbis, it must be eaten within 72 hours after killing. Consequently, that afternoon the producers had one of the striking experiences of the trip. In Chicago they had seen cattle killed by a quick knock on the head. In New York they saw men wearing skull caps cut the throats of the cattle with sharp knives, accompanying the action with prayer.

More visits to outlying retailers, with New York district salesmen, and travel to Philadelphia were the order of the day for Tuesday, the tenth of the circle tour. In Philadelphia on Wednesday, the eleventh day, the producers become acquainted with the methods of another food chain. Then on Thursday, the twelfth day, half of the group at Philadelphia, and the other half at Baltimore, carried on still more first-hand study with salesmen; and all the trippers rounded up that night at a hotel in Washington. At the Capital on Friday the thirteenth tour day, each of the producers went on his own. Most of them visited the Department of Agriculture, the grazing section of the Interior Department, the Forest Service, the Farm Credit Administration, the Supreme Court, and their congressmen; some went sightseeing.

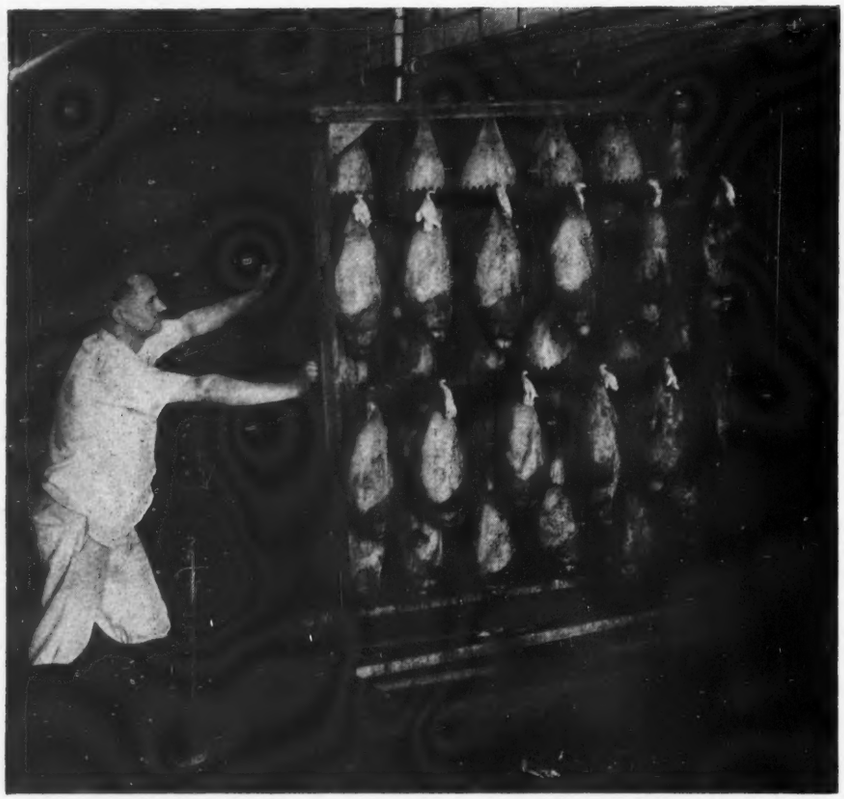
Arriving in Chicago on Saturday morning, the fourteenth day, the trip was concluded with a résume session. Last minute questions were put to their hosts.

This method with the farmers is one that could be followed by meat packers large or small. The smaller meat packer could follow a similar plan, as is done in each Swift "market study trip" for high school teachers, in one plant.

Out of his experiences in the Swift "producer trips" and other lines of activity, Mr. Simpson has an observation on the steps to be followed by processors on the long, hard, uphill road of promoting best relations with the producers of their raw materials: First, make their acquaintance; second, build confidence; third, give information fully and frankly. That looks as though it could well be applied to all industries.

QUALITY CONTROL in Food Manufacturing

By W. L. CAMPBELL*
General Manager of Manufacturing, Kroger Grocery and Baking Co., Cincinnati, Ohio



"During the smokehouse operation we increased the temperature in the house sufficiently to cook the ham so that a steam parboiling took place while the smoking was going on for eighteen hours."

PART II

WE formerly manufactured our top grade ham by what is known as the long process; i.e., a five-day pickle for each pound in weight, the hams being inspected, turned and repacked in the curing vats on the 30th, and 60th days. A selection was made each time as to those which we considered first class and satisfactory for this label. They were smoked by the long process which made a 30-hour smoke. I believe we used a higher proportion of sugar in our pickle, which consisted essentially of sugar, salt, and saltpeter, than is customary generally with the large packers and we enjoyed a premium for these hams.

We had the amusing case in one instance of our store at Durham, North Carolina, where over the meat counter were hung five or six of our hams and a similar number of one of the other well known brands. The store was robbed one night, and the thieves were careful to select all of our hams but did not touch a single one of the others. We had a good deal of amusement in joshing our packing house competitor friends, telling them that they should improve the quality of their product since even the thieves won't steal it.

Approximately one year ago we added to this line a shorter cured ham which also was precooked, at least sufficiently so that it was not necessary to parboil the ham in the home when the final cooking took place. In this instance, we opened the main artery of the ham and, while the ham was resting on a scale, pumped a given amount of pickle through the arterial system. This pickle was modified slightly from our regular pickle in that, for part of the sodium nitrate, an amount of sodium nitrite was added. The ham was then immersed in the vat containing a similar pickle and the curing was accomplished in fifteen days for a 15-lb. ham instead of 75 days, as would have been necessary under the other conditions. Then, during the smoke-house operation we increased the temperature in the house sufficiently to cook the ham, so that a steam par-boiling took place while the smoking was going on for eighteen hours.

In this case, to maintain quality, our plants are under the Government Inspection of the Bureau of Animal Industry and, also, we have maintained a member of our Food Foundation Laboratory in the ham operations at both our Columbus and Cincinnati plants during the time when there was any particular rush to turn out a quantity of these hams for particular holidays.

Now, as to our general set-up for maintenance of quality control. Seven years ago there was established in the Kroger Company what is now known as the Kroger Food Foundation, reporting to the President. Under the director of this Kroger Food Foundation come our chemical, physical and biological laboratories, our market research department and our home economics department. For the products which we manufacture ourselves, we also maintain in the manufacturing department two control laboratories, in our largest plants, one at our Cincinnati factory and the other at our Columbus bakery, with each in charge of a competent chemist who makes continual checks of the process in each of these plants. In addition to this, the Food Foundation

* The first part of this article was published in *Food Industries*, September, 1939, pp. 483–485. The entire article formed the keynote address at the Second Conference on Food Technology, Massachusetts Institute of Technology, Cambridge, Mass., June 28–July 1, 1939.

technicians travel into our other plants from time to time and make periodic checks on the ground in addition to our sending from each one of the plants samples from every lot of the products to the Food Foundation laboratories for continual checking.

On purchases from outside vendors, the Food Foundation makes analyses of the various offerings from a previously drawn up series of specifications for our buying department. After each shipment is received in the branch warehouses, representative samples are withdrawn from the lot and sent to the Food Foundation to be checked so that we are perfectly sure the material received is what we purchased. We analyze the coal we burn in our power plants, the oil we use in our automotive equipment, and the string and paper used in our stores—also all the raw materials that we use in our manufacturing operation.

I don't mean to infer from all of this that very elaborate machinery is necessary to obtain these results. Many of the physics laboratories of this country have Rowland gratings for use in studies of refraction of light. These glasses, etched with 20,000 or more lines to the inch, are the epitome of quality control, yet produced on a wooden machine. Professor Rowland died in 1901, so you can judge for yourselves the facilities available at that time. It used to be said at Johns Hopkins University that he could do any experiment in physics with merely a match stick, a test-tube and a piece of gas hose.

We can go even deeper into the case than this. We have the information from our purchasing department that the general quality of our outside purchases has improved 33⅓ per cent since the Food Foundation has been rendering their assistance in the last five years. This, of course, does not minimize the improvement in the general average of quality of food produced in the country, but certainly our Food Foundation has kept us in the vanguard of the procession. On the products which we manufacture ourselves, we do just enough outside business to check our current quality and prices; and reports from these independent sources have certainly been flattering.

In addition to the direct increase in profits secured by increases in sales on particular items where we have enforced this control, there are the corollary advantages obtained from our detailed investigation of the food processes.

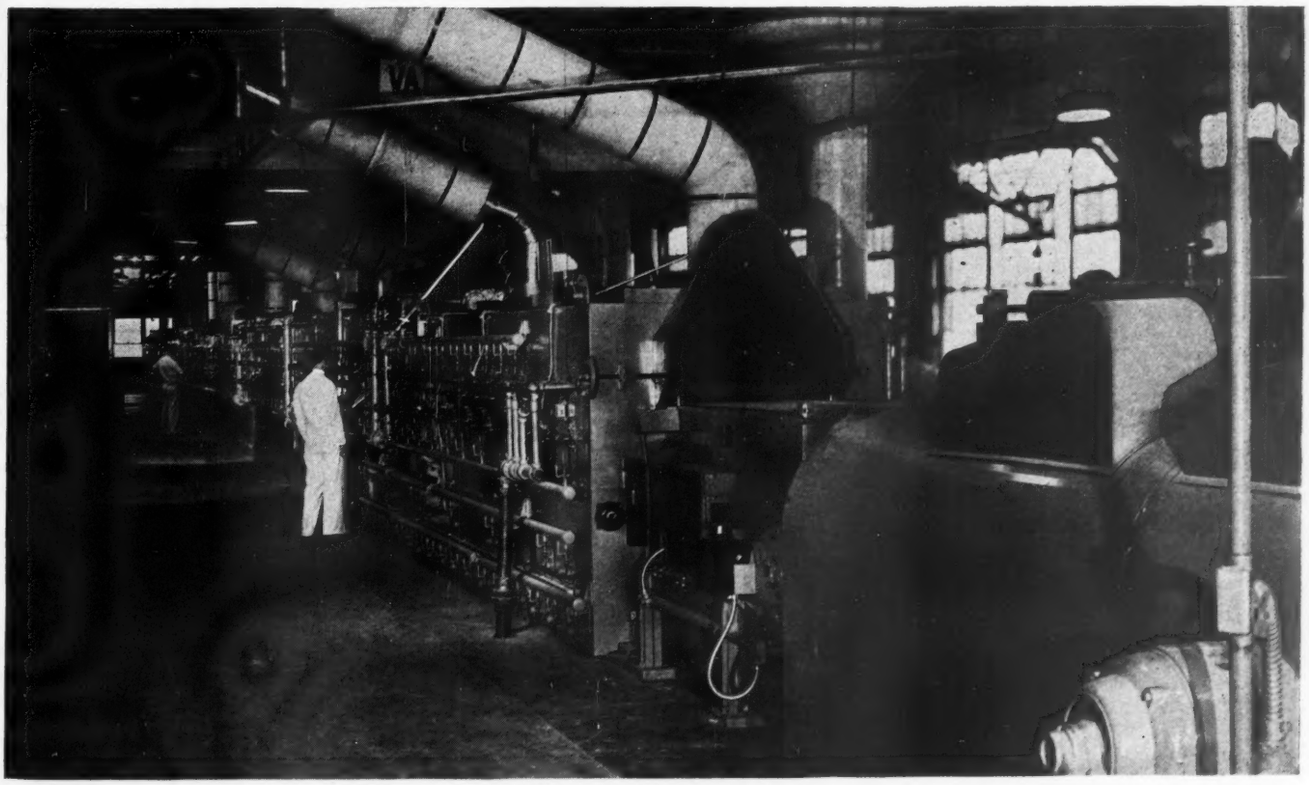
It would seem a far cry from the dyeing of leather in a tannery to the control of mold on bread, or sauce consistency on pork and beans, and yet proper pH is the key which unlocks the secrets of all three processes. We started on the experiments with ultra violet light to prevent mold on fruit cake and followed it up by attempts to minimize our produce losses and, finally, evolved the method of "Tenderay" beef which we have worked out in conjunction with the Westinghouse Electric and Manufacturing Company and the Mellon Institute. This method, we are told by experienced packers, is the first major improvement in meat handling for many years.

We adopted the continuous manufacture of pork and beans from the evaporated milk field. We secured the idea for the continuous method of bread packing from Mr. Henry Ford's process of pouring V-8 cylinder blocks in his foundry at River Rouge, Michigan.

We adapted the essentials of the Brown system of discipline in use on the railroad for many years, and from a steel company we secured their grievance forms.

One of our latest sidelights involves the production of thromboplastin, which came from our efforts to improve the old German dish of 'Hasenpfeffer" for the Cincinnati market. None of you may have the bleeding tendencies of some of the royalties of Europe, like the Bourbons or the Romanoffs, but if you have to have an internal operation in the next year, the surgeon will probably test the clotting time for your blood with this product of the Kroger Food Foundation.

To summarize the procedure on



"Our cracker and cookie production, except for small batches of miscellaneous items, is all on continuous-band ovens."

quality control, I would say we have consolidated our operations, where feasible; broken the processes down to their simplest form; and then, insofar as may be possible, made those processes continuous.

As previously mentioned, all our bread ovens are now of the traveling tray or traveling hearth type. Our cracker and cookie production, except for small batches of miscellaneous items, is all on continuous band ovens. Our peanuts are roasted in continuous roasters. Our pork and beans are blanched and cooked continuously. Our salad dressing production is a combination of batch and continuous operation, as are many of our candy processes. Still, we have really only just scratched the surface. The impossible is merely that which we have not yet learned to do.

Let us go back to the three items which we mentioned with particular reference to quality control, and see what this has done for the sales on these particular commodities.

Our first promotion on the new Tender Ham processed by the short cure was for Easter, 1938. We have had special ham promotions, with increased sales, on each one of the important holidays since that time until Memorial Day this year, when, considering both the hams and the shoulders, we moved seven times the number of pieces we did on Memorial Day last year.

On bread, I think it will be sufficient to give you an example in just one of our cities, which will be nameless because of some of the uncomplimentary things which might be said about the situation there. We formerly purchased bread in this city from one of the local bakers and were selling at the time a fair tonnage weekly. In the opinion of our experts, there was the poorest general quality of bread in this market of any of the large markets where we did business. There was only one wholesale bakery in the city which we considered turned out an excellent product, and conditions were so bad that after a visit by the head of our Bakery Department to one of the local bakeries that enjoyed a good deal of business, he remarked that it was the dirtiest bakery he had ever seen in his life. To rectify this situation, we installed a bakery of our own in the city, and after slightly more than two and one-half years operation we are now selling five times the amount of bread per week in this market, with fewer stores than we formerly had with the smaller tonnage.

As I previously mentioned, we not only get the increased business from quality control, but also a reduction in cost with many interesting side-lights which often become quite profitable later. In 1935, the American Bakers Association published a statement showing average figures for a wholesale baker, compiled from representative bakery and bakery service organizations. We at that time took the average of our thirteen bakeries then in operation for comparison, and found that our manufacturing department received from our stores 25 per cent less than the wholesale baker received from his customers. Our total cost of all ingredients was 8.6 per cent more than the wholesale baker, due chiefly to the richer formula we use. Our labor cost was 61 per cent less than the wholesale baker, despite the fact that our scale of pay is tops in all of the cities where we operate. Then with no advertising and selling cost, or vehicle operation charged against our manufacturing cost, and with a lower overhead, our final balance for the manufacturing department was 8.6 per cent more than that of the wholesale baker. With this efficiency record to shoot at, the general superintendent of our bakeries had quite a task. Nevertheless, from the sixth period of 1937 to the fifth period of 1939, he has still further improved the quality of his bread, increased his pounds of production per man-hour by 45 per cent, and further reduced his direct labor cost by 26 per cent.

I referred, in a good deal of detail, to the care which we are using in the handling of our coffee. We thought we had an excellent coffee business in 1929. Yet today, after the work done, we enjoy more than twice the total tonnage of coffee we had in 1929, although we are selling through 30 per cent fewer stores now than we did then. Today, this is one of the great coffee tonnages of the country, probably ranking fourth or fifth in magnitude, and is possibly the largest in our territory. We have had all sorts of pressure to reduce quality in order to meet price and yet, having maintained the quality, and met all of the prices that were thrust on us by competition, we are showing at the present time one of the sharpest rates of increase that we have enjoyed during the entire ten year period. The operating figures follow a similar course. From 1931 to 1938 the direct labor per thousand units has been reduced almost 40 per cent, while overhead per thousand units has been reduced slightly more than 65 per cent.

Mr. George Bernard Shaw advances the theory that virtue is merely insufficient temptation. Certainly, if you production people are tempted by your sales department to meet price by reducing quality, I hope you can gain sufficient encouragement from this Food Technology Conference to resist this temptation.

"We installed a bakery of our own, and in slightly more than two and one-half years we are now selling five times the amount of bread per week in this market—with fewer stores than we formerly had . . ."

Subsisting the Army in WAR

By PAUL P. LOGAN
Major, Quartermaster Corps, United States Army

WAR is no longer a phenomenon in which the military alone are called. It is no longer a pageant of marching troops and valorous battalions. War today is a contest of all the powers of the nations engaged—intellectual, moral, and industrial. It is not enough to mobilize the Nation's military strength. There must be a mobilization of her full economic resources—industrial, financial, and agricultural. These must be organized, coordinated, and directed with the same strategy that governs the operations of the purely military arms of the service. The success of a modern fighting force is directly and immediately dependent upon the ability of the Nation's resources to satisfy promptly its requirements in munitions.

In the whole category of munitions none is more important than subsistence, yet, with the exception of Thiers, historians have devoted but little attention to the question of subsistence of armies in campaign even though history is replete with military failures brought about by lack of food.

Frederick the Great made the assertion that the art of conquering is lost without the art of subsistence. General Sherman in his memoirs stated that the feeding of an army is a matter of the most vital importance and demands the earliest attention of the general entrusted with the campaign. Many other famous captains of the past have indicated in their writings the great importance which they attached to the timely and adequate supply of food to soldiers in campaign.

The big daily problem is succinctly stated by the soldier as he shouts—"When do we eat?" It was the major problem of the last war and will be the major issue in the next. It is a problem that can only be answered by careful pre-planning, economy in the home land, and full cooperation by all of our people.

A soldier consumes 5 lb. of food daily; a fourth of which is perishable. The difficulties attending the daily issue of subsistence in a major war are better visualized through the realization that for our Army during the World War 20,000,000 lb. of food had to be purchased, transported, stored, and correctly delivered each day to 10,000 destinations. A ship load of 9,500 tons of food was the daily requirement of the overseas forces.

U. S. Signal Corps Photo

One of the immense Gievres Q. M. warehouses partially filled with subsistence. Gievres, (Indre-et-Loire), France, July 31, 1918.

U. S. Signal Corps Photo

Flour Warehouse No. 5558 B, one of 21 warehouses for sugar, flour, beans and rice. On Nov. 11 there was enough flour in the warehouse at this depot to supply 100 divisions for 45 days. Gievres, France, Dec. 1, 1918.

How Rations are Handled in the Theater of Operations

Food supplies received in the Theater of Operations are given protected storage in warehouses and cold storage plants. If storage space is limited, the non-perishable supplies such as canned goods are piled on dunnage out in the open and covered with paulins.

Troops on the front are not required to requisition food supplies. The strength report received daily from each Division and Independent Organization is the basis for automatic issue. The impetus of supply is from the rear.

From Base, Intermediate, and Ad-

Based on an address before the Second Conference on Food Technology, held at Massachusetts Institute of Technology, Cambridge, Mass., June 28–July 1, 1939.

vanced Depots, raw materials are issued on request to field bakeries, butcher companies, coffee roasting plants, and field commissaries. The manufactured or treated products from these plants are dispatched daily to regulating stations or depots where train loads of balanced rations are assembled and forwarded to railheads near the front.

After the trains have been unloaded at the different railheads, the rations are forwarded by truck trains to distributing points, ration dumps, and organization kitchens. Sixty-six 1½-ton trucks are required daily to transport subsistence supplies to one division (26,000 men) on the front. Deliveries involve traveling at night without lights, usually over highways congested with traffic, through mud, and oftentimes through artillery shell fire, to unfamiliar destinations.

But a fighting man must eat. Regardless of conditions of roads, weather, battle action, troop movements, or action of the enemy, the ration supply must not fail.

Procurement of Food Supplies

With due regard to the conditions under which the campaign is carried out and to the needs of the civilian population, whether in friendly or enemy territory, the Commander of the Field Forces causes procurement to be made locally of those food supplies which may be readily obtained. Such purchases are usually limited, both in variety and quantity, because of the irregularity of supply.

The bulk of all subsistence is purchased in the home land and shipped to the Theater of Operations. The Quartermaster Corps is charged with this duty.

The Continental United States is divided into nine Quartermaster procurement zones, contiguous with the nine corps areas. Each Zone Quartermaster is charged with the purchase of all the food required by troops stationed in posts, camps and stations within his zone. The procurement in peace or war time is by competitive bidding. Purchases for expeditionary forces, or for special forms of food such as emergency and reserve rations are made by direction and under supervision of the Office of the Quartermaster General, Washington, D. C. When large quantities are purchased from one commercial establishment, inspectors are usually sent to the point of origin and the goods are inspected for quality, quantity and condition before being loaded for shipment. Small shipments are inspected upon receipt at destination. No foods are accepted which fail to meet the standard of quality indicated in the Invitation for Bids, as defined in Federal Specifications.

How do these war time food problems affect the producers and processors of foodstuffs in the home land? Obviously, the problem is not one of quantity because men must eat wherever they are. The average per capita annual consumption of food by the citizens of the United States is 1,446 lb. The soldier consumes about 1,816 lb. But, in a nation of 130,000,000 people, the food increase required to support 4,000,000 men under arms would be less than 1 per cent over normal production. The only concern as to the sufficiency of supply would be found in those items of the daily diet which are not produced in this country in sufficient quantities, such as sugar, or those not produced at all, as coffee, and spices. Fortunately, the United States is blessed with an abundance of food and in more variety than any other nation in the world. Not only does this happy condition apply to food but to most other materials or munitions upon which any modern army is so dependent in time of war.

The real problem in a future major emergency which will confront the food industry will be the necessity of changing from normal processes in order to provide special forms of foods required to be prepared and packaged in a manner calculated to best conserve space and weight, to lower storage loss, to minimize the hazard of contamination by poison gas, and at the same time be nutritious, palatable, and well adapted to field cooking.

Since the Quartermaster Corps is charged with the feeding of the Army, it not only attempts to keep abreast of commercial developments in the food world but also conducts considerable research work in battlefield rations.

One experiment conducted by the

(Turn to page 580)

U. S. Signal Corps Photo

Field bakery at Is-Sur-Tille. Showing rows of field ovens in operation at Is-Sur-Tille, France, Sept. 2, 1918.

U. S. Signal Corps Photo

Open storage of subsistence. These stores are in lacquered containers and covered with tarpaulins. There are 50,000 of these in stock in this one pile. Gievres, France, Dec. 1, 1918.

Forty Years of PICKLE SALTING

Salting, curing and care of cucumber pickles, onions, cauliflower, dill weed and peppers

Part II*

By W. G. WORMLEY
San Jose, Calif.

BEFORE discussing the formula for pickle salting a few general remarks on salting may assist one in producing the best results. Salting of pickles is like the manufacture of any other commodity, for unless the raw material is of the best, the finished product cannot be of high grade. If possible, pickles should be salted on the same day they are picked. If circumstances compel that pickles be carried over night without salting, care must be taken that they do not heat or sweat and thus develop mold, because this will cause much trouble later on.

If pickles have been, of necessity, carried over night, before they are salted they should be carefully assorted to eliminate any bad pickles that may be in the lot and would cause trouble later. For example assume that you have one bushel of cucumbers that contains only ten spoiled ones. This bushel is dumped into the tank with the others. After the pickles are cured and you wish to sell the salt stock, and while the tank is being inspected by the buyer, the inspector is sure to find those ten bad pickles that were bad when dumped into the tank. And usually he will reject the entire tank because of those ten bad pickles.

If you have any questionable pickles, the safe rule is to salt them separately and thus *know* what you have in your tanks.

Too much cannot be said in favor of cleanliness and system at a salting station. It is much easier and cheaper to keep clean than to clean up at infrequent periods. Furthermore, spoilage is often caused by insanitary condition of the place in which the stock is salted. Such conditions often lead to bacterial infection of the stock, with losses as the inevitable consequence.

In giving the formula for what I consider to be the best and latest salting method, I assume that we have a salting station properly supplied with tanks and equipment, and that it is clean and in a sanitary condition and ready for use and that the green pickles are the best that can be obtained. Figs. 6, 7 and 8 show the plans of small, medium and large salting stations.

Because every state or country will require some variation in the salting procedure, dependent on local conditions to be met, only general figures can be given. Salters in each locality must work out their own formulas in accordance with their average air temperatures, water, soil, and growing methods.

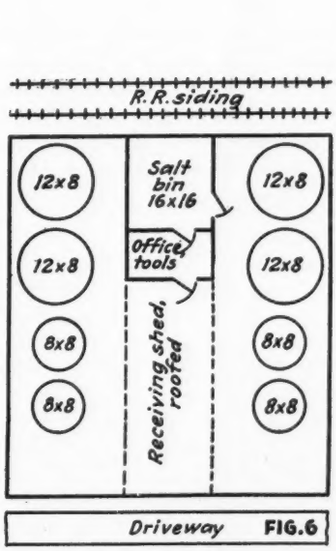


FIG. 6

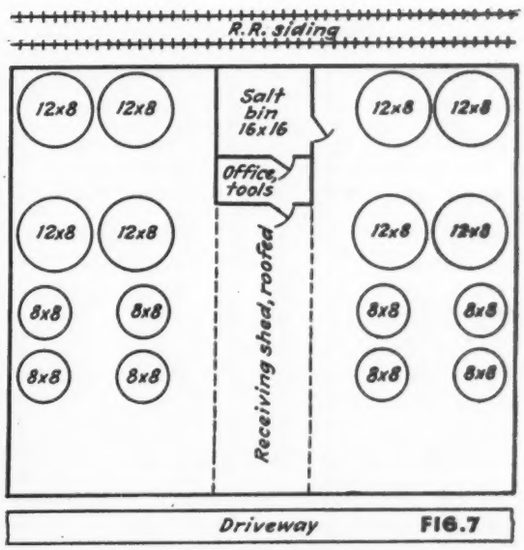


FIG. 7

Fig. 6—Plan of small size salting station. Equipment includes:
4— 8x8 ft. tanks, 325 bu. each ..... 1300 bu.
4—12x8 ft. tanks, 750 bu. each ..... 3000 bu.
Total tank capacity ..... 4300 bu.
4 olive casks, 20 bu. each, for early salting.

Fig. 7—Plan of medium size salting station. Equipment includes:
8— 8x8 ft. tanks, 325 bu. each ..... 2600 bu.
8—12x8 ft. tanks, 750 bu. each ..... 6000 bu.
Total tank capacity ..... 8600 bu.
8 olive casks, 20 bu. each, for early salting.

Effect of Latitude on Salting Procedure

As a general rule, pickle salters in all cold or northern localities can salt with a much weaker brine than in warmer climates. It is suggested that salters in Minnesota, Wisconsin and Upper Michigan would be safe in salting the tanks at 36 deg. (Sal.), while Lower Michigan, Ohio, New York, Pennsylvania, Northern Indiana and Northern Illinois would use 38 deg.

* Part I of this article appeared in FOOD INDUSTRIES, September, 1939, page 486.

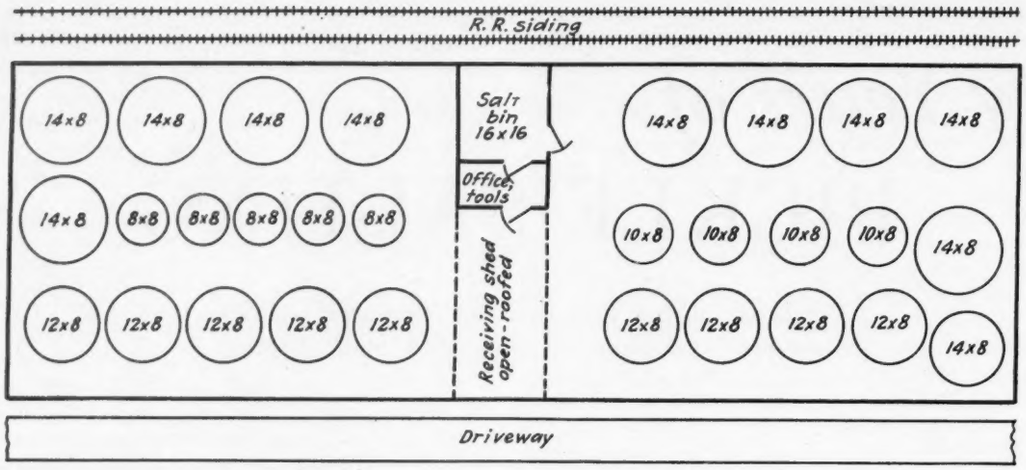


Fig. 8—Plan of large salting station in which the portable olive casks are not shown. Equipment includes:

5— 8x8 ft. tanks, 325 bu. each ..... 1625 bu.
4 —10x8 ft. tanks, 450 bu. each ..... 1800 bu.
10—12x8 ft. tanks, 750 bu. each ..... 7500 bu.
10—14x8 ft. tanks, 900 bu. each ..... 9000 bu.

Total tank capacity .....19925 bu.

10 olive casks for early salting, 20 bu. each. Note that salt bins are all 16x16 ft. for the reason that each must hold a carload of salt.

Sal. Further South the initial brine strength would probably be 40 deg. Sal. For convenience the 40 deg. Sal. territory is considered for discussing the salting formula.

How to Start the Season

At the beginning of the season, the pickle receipts are usually small and at this time it is best to use open head barrels, olive casks or small tanks for salting these diminutive quantities.

Before using a container, whether it be tank or cask or barrel, it should be washed with fresh water. Then cover the sides, bottom, pump box and cover with a thin whitewash freshly made from unslaked lump lime and applied with an ordinary whitewash brush. Permit this whitewash to remain on the sides of the tank for about 20 minutes. It should not be allowed to dry and stick to the tank. Then the tank is washed thoroughly with fresh water and permitted to dry for a short time. Now cover all the parts that have been limed with a good coat of 100 to 120 grain vinegar, by applying it with a wide paint brush. This is to neutralize any remaining lime.

Lye and other chemicals have been used for the preliminary sterilization, but the lime and vinegar treatment has given good results and both are easy to obtain. I am aware that chemists and bacteriologists do not favor the use of lime, saying that they cannot conceive what good it could do. In rebuttal, it can be said that I have known spoilage to occur in a station in the same tanks, year after year, and that the spoilage ceased after the tanks were treated with lime, which suggests that the lime treatment has had the effect of destroying a focus of infection. The vinegar is merely to neutralize the alkalinity of the lime after it has served its purposes.

The container is now clean and sterile and ready for brine.

For the purpose of preparing a supply of brine, select a tank in the center of a group of tanks and use this in which to make 40 deg. Sal. brine and keep this tank full of 40 deg. brine at all times. This is done so that the brine temperature will be the same as the air temperature. But if the brine is not made in a tank, then the water used for making brine should be of air temperature to insure fermentation. If city water is being used, and it is very cold, a storage tank should be provided in which to store the water for brine making so that it will be warmed to air temperature.

To make a tank of 40 deg. Sal. brine we use a simple brine maker. Take a clean 50 gal. barrel, a 1½ in. galvanized nipple, 12 in. long, threaded on one end, two 1½ in. lock nuts and the necessary 1 in. hose, with coupling on one end, to be used as outlined in Fig. 9.

The brine maker is placed at the tank to be filled with brine and the hose connected with the water supply. A quantity of salt in open barrels or boxes is placed near the brine maker and we are now ready to prepare the brine.

First place 10 in. of salt in the brine maker and then turn on the water supply, slowly at first until the brine maker is full and the brine running out of the 1½ in. pipe into the tank. Now place a salometer in the brine

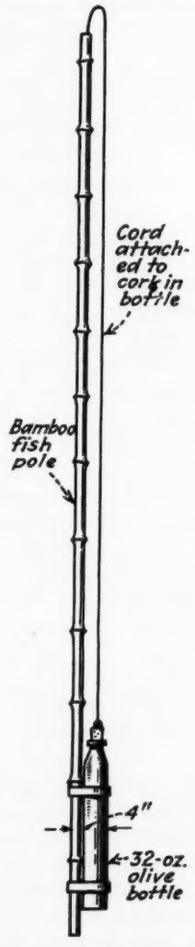


Fig. 10—Device for taking brine samples from bottom of pump box. A 32 oz. olive jar is firmly attached o a 10 ft. fish pole, with a cork that can be pulled out by a cord.

maker, inside the rubber loop as shown in Fig. 9. If the salometer does not show that the brine tests 40 deg., add more salt; and, if it reads more than 40 deg., increase the flow of water until the salometer shows 40 deg. Continue the addition of salt so that a 40-deg. test is maintained, and proceed in this manner until the brine tank is full.

Brine made thus and held in a supply tank is ready for instant use and is at air temperature, and can be pumped to the tank being filled with pickles. Or if a pump is not available, the brine can be trucked in open head barrels and dumped into the tank.

In using a cask for salting cucumbers, place 9 in. of 40-deg. brine in the bottom of the cask and dump pickles into the cask until it is filled within 4 in. of the top. Then place the cover on the pickles and key it down securely and add enough 40-deg. brine to bring the brine 3 in. above the cover; next add 13 lb. of salt to every 100 lb. of pickles in the tank. This will make a 40-deg. Sal. brine when all the salt is dissolved.

Proceed in this manner as long as the cucumber receipts are not sufficient to fill a large tank in one day.

Pickles that are salted in barrels, casks or *small* tanks will ferment much more quickly than those in large tanks; and when they show a good fermentation they may be used as a starter for large tanks by dumping 100 gal. of these fermenting pickles from one of the casks, into the tank being started.

When the pickle crop is well advanced, and pickles are being delivered in quantities sufficient to justify the starting of a large tank, it is important that the tank for this purpose shall have been cleaned and prepared in the manner described and that the pump box has been placed in position in the proper manner.

The ordinary pump box is not suitable. Each tank should be supplied with a pump box made as follows: Four pieces of lumber 1 in. x 8 in. x 7½ ft. long, smooth on all four sides, are nailed together making a tight box 7½ ft. long. One end—the bottom end—of the box is perforated with ⅜ in. holes drilled ½ in. apart and 18 in.

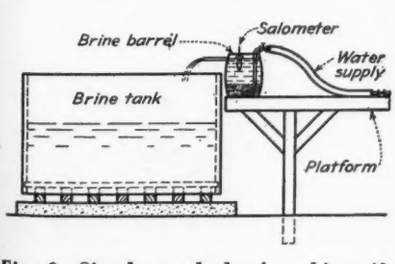


Fig. 9—Simple method of making 40-deg. brine.

from the bottom of the box on all four sides. The box, being water tight except at the bottom, insures that when the tank is "pumped" the bottom brine is carried to the top and over. (See Fig. 3.) (The pumps used for this service will be described later). Now run 9 in. of 40-deg. brine at air temperature into the tank and add to this 100 gal. of fermenting brine taken from casks or from a tank that has been fermenting well. Then dump the pickles into the tank as fast as they are received, also adding 13 lb. of dry salt for every 100 lb. of pickles dumped into the tank.

IF for any reason the tanks is not completely filled, and the cover is placed on a partly filled tank, the cover should not be removed at any time unless sufficient new green pickles are on hand to entirely cover and depress below the surface of the brine the stock already in the tank, unless the cover is replaced at once. Partially fermented pickles will spoil very quickly on exposure to air. After pickles are once in the brine, they should never be exposed to the air until they have become thoroughly cured.

During the period of filling the tank, the pickles should be kept level in the tank to insure a uniform product and to prevent the shriveling which occurs if pickles are permitted to pile up in one place, thus increasing the weight on the pickles in the bottom of the tank.

When a tank is being filled rapidly and the brine is more than 10 in. below the top of the pickles, sufficient 40-deg. Sal. brine at air temperature should be added to bring the brine up to within 4 in. of the top of the pickles.

If pickles are coming in slowly, or if for any other reason the pickles are loose and there is too much brine in the tank, thus making the handling difficult, pump out a cask full of brine and save it to use on the tank after it is covered for the night. This will save expense and aid fermentation, and make it possible to get the required number of bushels of pickles into the tank.

When you have the required number of bushels of pickles in the tank, or after the pickles have all been received for the day, level off the pickles in the tank and place the board cover on them. Be sure that it is tight so that the pickles cannot get from under the cover.

When the board is securely keyed down, run 40-deg. brine at air temperature into the tank to completely cover the cover boards. And if the tank is full and this is the final closing, then run in sufficient additional brine *to reach the top of the tank staves.*

Don't allow the brine to go below 40 deg. Sal. When pickles are coming in rapidly and the strength of the brine is lowering, add dry salt often, in the proportion of 50 lb. of salt to 50 bu. (2,500 lb.) of pickles, scattering the salt uniformly over all of the pickles. The balance of the 13 lb. of salt per 100 lb. of pickles is then placed on the top of the tank cover after the tank is closed for the night. If the top brine test is not weakening and the tank is to be finally closed, i.e., it is as full as it should be, the entire amount of dry salt, that is, 13 lb. per 100 lb. of pickles, may be placed on the cover when the tank is finally closed.

Guessing, or measuring salt or pickles by volume, is very dangerous. Every pound of salt and every pound of pickles should be carefully weighed on a tested scale, and recorded on suitable forms for that purpose.

The following is the correct number of bushels of pickles that should be salted in each size tank:

6′ x 7′	tank	150 bushels
8′ x 8′	"	325 "
10′ x 8′	"	450 "
12′ x 8′	"	750 "
14′ x 8′	"	900 "

If you are short of tank capacity, more pickles may be placed in these tanks but the result will not be as good as if the foregoing proper amounts were used.

At the close of the season, receipts should be watched carefully and, even if you do crowd the last tanks to be filled, crowding is better practice, notwithstanding, than to have a partly filled tank to care for. In other words, *end the season with only full tanks if possible.* Partially filled tanks are difficult to care for properly because of the physical difficulty of reaching down into a deep tank. If the pickles are coming in very slowly and a tank is more than three days in filling then, beginning with the fourth day, on each morning add 5 lb. of salt for every 100 bu. of pickles already in the tank. Agitate (pump) the tank brine to dissolve the salt and increase the brine strength. Top brine is the quickest to be diluted by osmosis or by rain. *It must never be allowed to go below 40 deg. Sal.*

1. On the day after the tank has been filled and finally closed, or 2, if the air temperature is at least 5 deg. F. warmer than the brine temperature, pump the tank thoroughly to insure a uniform mixture of the brine. This

pumping may or may not even up the test on top and bottom of the tank, but if the foregoing instructions have been carefully followed the tank should test 40 deg. Sal. at top and bottom. (See Fig. 10 for the apparatus for obtaining a sample of bottom brine.)

In testing the density of pickle brine, a regular salometer is used and, for a container in which to test the brine, a cylindrical 32 oz. olive bottle is excellent. This olive bottle is fastened on the end of a common bamboo pole, about 10 ft. long, the pole serving as a handle for holding the bottle and also making it possible to get the brine test at the bottom of the tank.

The olive bottle is fitted with a large cork, to which is attached a net cord. The other end of the cord is fastened to the top end of the pole. A brine sample from the bottom of the tank is obtained by placing the cork in the mouth of the empty bottle, and forcing the empty bottle inside the pump box to the bottom of the tank by means of the pole. After the bottle strikes the bottom of the tank, pull the net cord and thus remove the cork from the mouth of the bottle. When the cork is removed, the brine from the bottom of the tank will fill the bottle, and the air that the bottle contained will rise to the surface of the brine in the pump box in large bubbles. When these bubbles have ceased rising, pull up the bottle and test the brine therein.

The test of the top brine should be taken at several points on the top of the tank to obtain a good average test.

Should the closing test be less than 40 deg. Sal., raise the test by only 2 deg. each day until 40 deg. is reached. Then raise the brine strength only 1 deg. every three days until it reaches 50 deg. Sal. After that only 1 deg. Sal. every week for the next seven weeks, after which raise the brine test 1 deg. every two weeks until 60 dg. Sal. is reached. Hold the brine test at this point thereafter.

If the air temperature drops to 0 deg. F. and remains at that point for any length of time it will be necessary to raise the brine test high enough to keep the brine from freezing. To raise the brine strength by 1 deg. Sal. every three days in a 12 ft. tank, it will require the addition of 50 lb. of dry salt daily. In raising the brine test, or in adding the salt to a tank at any time, the entire amount of salt should never be placed on the tank at one time but should be added slowly, part in the morning and part in the evening. Always keep accurate records of amounts to be added. Changes in brine strength toward stronger brines must always be very gradual or shriveled pickles may result.

The foregoing discussion as to the quantity of salt to be added is approximate and should not be depended upon blindly. The only safe rule is to use the salometer and know that you have a correct test at both top and bottom of the tank.

The following rules need to be emphasized:

1. Be sure your tanks are sterile before you start.
2. Be sure your water supply is pure and at air temperature, never colder.
3. Be sure that the pickles you salt are in perfect condition before dumping into the tank, as "heated" pickles can cause much trouble.
4. Be sure your scales are correct, for you must have your proportions accurate.
5. Be sure, when adding salt, that it is added slowly and spread evenly over the entire top of the tank and that it is not added all at one time or all in one place.

If the pickle tanks are enclosed in a building, a scum of a yeast-like growth, called *Mycoderma,* will gather on the top of the fermented pickle brine very rapidly. This scum must be removed every three days, or more often if necessary, and the scum must be taken away from the tanks as far as possible, for it will not only putrefy and be a nuisance, but it may be a possible source of bacterial disease of pickles.

The removal of the scum from the tanks is accomplished by skimming with a skimmer made in the shape of a scoop or dust pan as shown in Fig. 11. The reason for skimming is that this scum has the property of destroying the lactic acid formed by the fermentation, and this acid acting in combination with the salt is what prevents the spoilage of the pickles.

The correct brine strength at which a tank of pickles should be closed has been given. When a tank is closed, the brine test should never be permitted to weaken but must either remain stationary or rise slowly. It must *never* be permitted to become weaker. If, through error, the brine test is found to be actually higher than it should be, do not try to lower it, but keep the test stationary until the proper length of time has elapsed for the brine test to reach the point where it now is. And then proceed to raise the test in accordance with the rule as previously indicated.

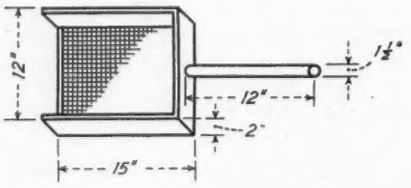


Fig. 11—A tank skimmer is something like a dust pan with a screen bottom.

The brine test should always increase in strength, never weaken, and if the pickles are to be kept from year to year, the test should be raised at least 3 deg. Sal. per year and must never be permitted to go lower than the highest point previously reached.

Up to now the lactic acid content of the pickle brine has not been mentioned. Few salters have the equipment to determine the acidity test, but if the salting is carefully done, the acidity test will be correct.

If, however, the acidity tests less than 0.2 grains, figured as acetic acid, trouble may be expected such as *black brine* and bad odor. But, as stated before, if the salting is accurately done the acidity test will usually be about 0.7 grain.

Spoilage usually originates from carelessness and may be caused by having the brine test either too low or too high. In fact, I have seen more spoilage in high brine than low.

Pickle Defects

Bloaters or hollow pickles have usually been attributed to the manner of salting, but we have proven that the character of the season, the soil and the water somehow cause most of the bloating. The pickles have become hollow before they are placed in the tank—not afterwards.

Improper irrigation is also a source of spoilage, as too much irrigation is very dangerous. In salting irrigated pickles you must be sure your grower is familiar with the pickle crop and does not over-irrigate and cause the salter trouble. Truck farmers know how and when to irrigate crops; ordinary farmers seldom understand it.

In connection with spoilage, so-called ropy brine or sour brine should be mentioned. This causes much needless alarm, for ropy brine seldom does harm if properly treated. The practical causes of ropy brine are numerous; salting in cold water, lack of sufficient salt, sudden change of temperature from hot to cold and exposing a tank in a closed station to a cold wind by opening a door or window next to a fermenting tank, thus lowering the temperature suddenly.

In the final installment of this article, to appear in FOOD INDUSTRIES *for November, 1939, the author will discuss the salting of onions, cauliflower, dill weed and peppers.*

Competitive Interests Push Food Trucks Off the Highways

OXCART and prairie schooner rolled over the continent during the early years of our expansion, hindered only by the attacks of Indians and the hazards of nature. Soon toll roads, canals and waterways spread a traffic net work over inhabited parts of the country. Men and merchandise moved freely to and from the frontiers. Railroads then expanded in every direction, welding the country into the world's greatest free market.

Our Constitution's declaration that—"No state shall lay any imposts or duties on imports or exports . . . ." encouraged the development of national resources and the founding of great industries. It guaranteed the free flow in trade of the products of these industries between all parts of the country. This guarantee cemented a foundation on which this country was destined to rise in a short span of years to the world's richest and most productive country, attaining thereby a living standard attained by no other nation.

Has this destiny been fulfilled? Have we abandoned free interstate trade because we no longer need to develop, expand, progress?

By IVAN C. MILLER
Distribution Editor, Food Industries

PRIOR to the period of intense railroad construction when transportation in this country was carried on by horse and wagon on roads and by boats on rivers, canals and coastal waters, neither the states nor the Federal Government attempted any important degree of regulation of transportation.

Discrimination by the railroads in favor of persons, places or commodities, as the expansion period drew to a close, forced states to legislate to curb abuses and eliminate discriminatory practices.

Soon, however, state legislation itself ushered in discriminations and set up barriers to free interstate trade. The creation of the Interstate Commerce Commission was in a large measure the result of states regulating railroads to the benefit of local interests. And thus the Interstate Commerce Commission began to function as the Federal Government's regulatory body to dissolve state barriers to the free flow of trade over the railroads.

The extent of transportation barriers which existed in 1905 is revealed by testimony before the United States Senate Committee on Interstate Commerce, "Practically all the state commissions that have been active in the matter of regulating railway rates have regulated largely with an eye to establishing local protection. Today you can establish protection by means of regulation of railway rates in an as-

BE PREPARED TO STOP
TRUCK STOP WEIGHING
TRUCKS AND BUSSES STOP OFFICIAL WEIGHT STATION
TRUCKS BUSSES STOP
KANSAS HIGHWAY COMMISSION U.S. BUREAU OF PUBLIC ROADS
TRUCKS AND BUSSES STOP
TRUCKS AND BUSES STOP 300 FT. AHEAD

Courtesy of U. S. Public Roads Administration

Stop signs like these frequently indicate the presence of a trade barrier ahead.

tonishing degree of efficiency; and practically all of the states commissions that have been active in railway rate regulation have done that."

Is it surprising then that the railroads, with an intimate knowledge of the effectiveness with which state trade barriers could be used to smother competition, should use their influence to place thousands of laws on the statute books of the 48 states and the District of Columbia, regulating and taxing trucks and the commodities they transport over the highways?

These thousands of laws help to maintain the high cost of distribution. They constitute major hurdles to free trade.

State trade barriers—whatever their form—are adopted as measures to regulate and protect the health and safety of residents or to provide tax revenue. Such trade barrier laws, regardless of intent, serve also to protect certain interests from competition. Usually the interests protected are local interests. In the case of the barrier set up to impede the free flow of trade transported by trucks over the highways, not only is the competition of local interest within the state affected, but also the competition between railroad transportation and truck transportation.

The godfather "interests" are always present to give their blessings at the christening of each infant trade barrier law.

It is not necessary to discuss the merits of either side in the controversy between railroad and motor truck transportation. Each type of transportation has its place in that system of economic transportation in this country which assures the minimum cost of distribution. Would this country have progressed to where it is today if the canal and river transportation interests had been protected against the inroads of the railroad or the horsedrawn vehicles from the competition of the automobile and truck?

That the railroads have encouraged the passage of state laws which serve as barriers to free trade in commodities transported by trucks is beyond question.

The Texas law regulating the net load limits of trucks operating in the state is a two edged trade barrier. It limits the competition of local stock raisers supplying the Fort Worth market. The maximum load is so low that only short hauls are profitable. Most states adjoining Texas have a more liberal load limit and, of course, the very low load limit in Texas tends to restrict the flow of livestock from bordering states to Fort Worth. The law also handicaps truck transportation in favor of railroad transportation.

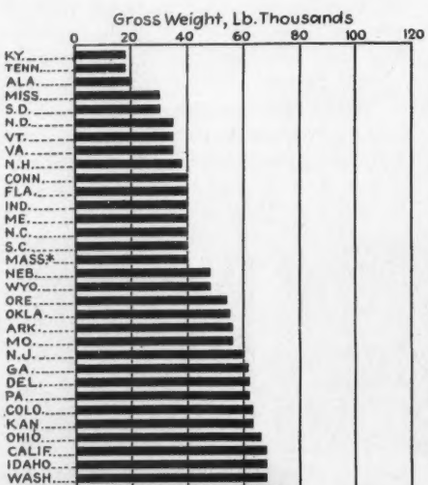
The Texas law was passed with the apparent intention of protecting the highways of the state from the wear and tear of excessive loads on trucks. The law is very enlightening for the scientific truths it reveals. A truck traveling to or from the nearest railroad station with a 7-ton load will damage the highways no more than the same truck with a 3½-ton load if it does not bring merchandise to or from a railroad station. The maximum load tolerance in Texas is 7,000 lb. (except when transporting to or from the nearest railroad station when 14,000 lb. becomes the maximum.

There are thousands of state laws regulating and taxing trucks engaged in commerce. During the current year more than 10,000 bills affecting transportation by trucks were introduced before the state legislatures. Some 1,200 bills have been enacted into law. No small number of the bills submitted and of those enacted set up barriers to free trade. The very number of laws and requirements (varying as they do from state to state) constitute a hazard to free trade. Often compliance with the laws of one state necessitates violation of the law of other states.

Not the least of the trucker's difficulties is the necessity of informing himself in regard to the law. This is not always easy, for some of the state laws are complex and many of them are subject to frequent change, especially in respect to reciprocity provisions.

Many states have reciprocity agreements with each other. Only a few states have full and complete reciprocity with each other. Reciprocity may vary according to the type of carrier and may also be limited to any one or more of the following: weight restrictions, licenses, taxes or operating regulations. It requires a lawyer to unravel the complicated structure of reciprocity, the whole balance of which may be dislocated by the overt enforcement act of any one state or by the action of the legislature or state highway authorities of any state.

At the end of last July, St. Louis unearthed from the Missouri state archives an eight-year-old law, never before enforced, requiring motor common carriers to obtain permits from the public service commission at fees ranging up to $500 per truck. City and state officials blockaded bridges entering the city. Traffic was tied up. Several hundred truck drivers were arrested. Trucks and loads were impounded. Freight movements by truck virtually ceased.

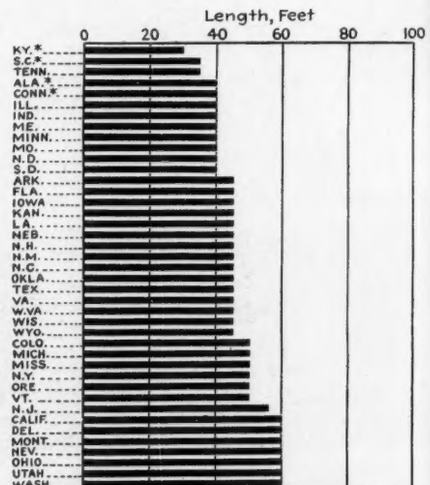


* Plus weight of trailer having capacity not in excess of 1,000 pounds

Courtesy of U. S. Department of Agriculture

Maximum Gross Weight of Permissible Combination of Motor Vehicles

The maximum gross weight varies all the way from 18,000 lb. in Ky. and Tenn. to 120,000 lb in R. I. (States not shown limit gross weight in accordance with formulas which take into account distance between first and last axle.)



* Tractor-Semitrailers: These States do not permit full trailers

Courtesy of U. S. Department of Agriculture

Maximum Length of Combinations of Vehicles

The maximum length of combinations of motor vehicles permitted by the different states varies from 30 ft. in Kentucky to 85 ft. in four States, while Maryland and Massachusetts have no limit at all.

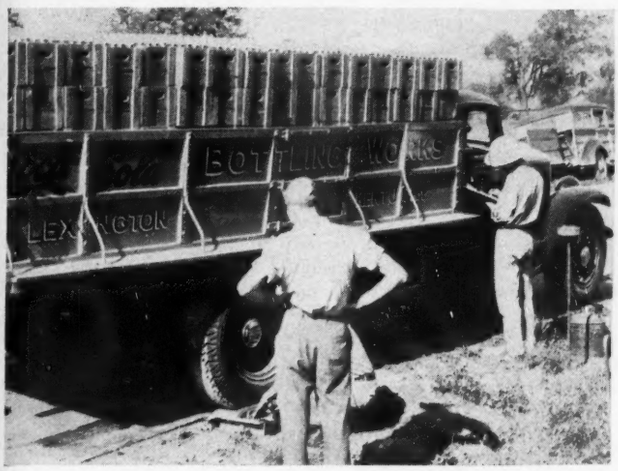
The truck capacity estimates of St. Louis officials, not rated capacity, were used as a basis for the tax fee. One interstate trucking company with an annual gross income of about $770,000 reported that the additional tax required of it by the enforcement of the law would amount to more than $200,000.

St. Louis' enforcement of the state law, from which St. Louis obtained half of the tax fee, soon became contagious and spread to the principal "ports of entry" of the state, Kansas City, St. Joseph, Hannibal and others. Interstate trucking bore the brunt of the enforcement. Retaliation was threatened by all bordering states.

The laws of the various states restricting gross weight of any permissible combination of vehicles vary from 18,000 lb. limit in Kentucky and Tennessee to 120,000 lb. limit approved by Rhode Island (See Chart I). Some states which do not place a load limit in pounds, determine permissible weight by formulas that take into account the distance between the first and last axles; others make the basis tire-width, wheel loads, axle loads, net loads, or gross weight either for a single vehicle or for specified combinations of vehicles.

Courtesy of U. S. Public Roads Administration

Note the license plates on this truck transporting merchandise in more than one state.



Testing weight by "wheel-at-a-time" load meter. There is no compensation for any damage to axle or housing.

Courtesy of U. S. Public Roads Administration

The very existence of these variations in load limits greatly restricts and often prohibits the movement of motor transportation between adjoining states. Rhode Island permits 120,000 lb. maximum load, her neighbor Connecticut permits only 40,000 lb. Montana permits 84,800 lb., while bordering her Wyoming permits but 48,000 lb. Illinois permits 72,000 lb., Kentucky's limit is 18,000 lb.

By their non-uniformity, these laws effectively bar trucks which can operate in certain states from operating in others. By placing very low limits on size, weight or number of units, these laws create a situation in which long-haul transportation is often impossible, because unprofitable.

Maximum dimensions vary from state to state—width, length (See Chart 2) and height. Maximum allowable weight per axle and per tire are also variables, differing greatly in different states. In order to enforce these truck regulations, many states have erected inspection stations along the highways at their borders where each transport vehicle entering the state is checked and weighed before it is allowed to proceed or is turned back.

Frequently, "truckers" are compelled to stop six or eight times before reaching destination points, and drive up on these flimsy "one-wheel at a time" road scales, at great danger to their trucks. If an axle is broken, there is no reimbursement for the cost of the repairs.

In regard to the number of units permitted to be drawn by a single truck or tractor and the length of each unit or combination of units, there is again considerable diversity. At least four states, although permitting tractor-semi-trailers, do not allow full trailers to be used. At the other extreme, eleven states have no limitation on the number of trailer units. The length permitted on combinations, whether tractor, semi-trailer, or trucks with full trailers, also varies within wide limits. Kentucky permits a maximum length of 30 ft., Georgia specifies 85 ft., and Maryland has no limit at all.

In addition to size and weight requirements, there has been a tremendous mass of other legislation having to do with particular parts of the truck or the equipment that must be carried. Lights, mufflers, fenders, steering gear, windshield wipers, defrosters, tool kits, fire extinguishers, locks and keys, bumpers, windshields and fuel tanks have been the objects of extremely detailed, highly divergent and sometimes obscure legislation.

Sometimes these laws, enacted to protect local interests, have boomeranged, causing greater handicaps on other state interests than benefits to those interests for whose protection the law was enacted. Again the mere anticipation of the effects of some of the laws has prevented enforcement of the law and often caused repeal.

The South Carolina law of 1933 which prescribed a maximum width of 90 in. and limited trucks to a gross weight of 20,000 lb., was never enforced and has recently been repealed. It was found in the district court that enforcement of the law would necessitate increases in transportation rates on commodities shipped into, out of and through South Carolina, and "render it practically impossible for a

large part of their interstate commerce now conducted by trucks to use the roads of the state." It was also found that textile and lumber mills in South Carolina would be placed at a disadvantage, that the costs of fertilizer would be increased to farmers and that enforcement would discriminate against South Carolina truck farmers and vegetable growers in favor of their competitors in other states. It was apparent that this law would injure, if not destroy, this industry in South Carolina.

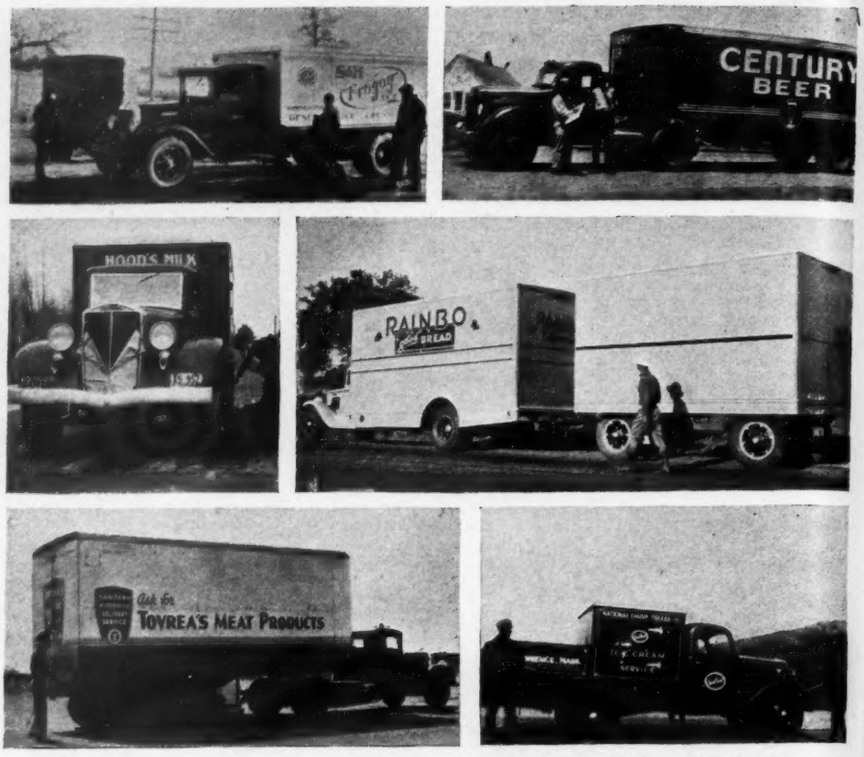
The threat of the South Carolina law was especially serious in view of the low weight limitations already in effect in Kentucky and Tennessee. Both of these states have a maximum gross weight limitation of 18,000 lb. If the size and weight laws of South Carolina, Kentucky and Tennessee had all been enforced, an effective barrier against long distance trucking would have been stretched from the Atlantic Ocean to the Mississippi River.

The license requirements and taxes on out-of-state motor trucks not only materially increase the cost of distribution, but raise effective barriers to free trade. Motor trucks entering most states are required to do one or more of the following: Register; deposit cash bond; obtain license or permits; pay ton-mile taxes, gross receipts taxes, or personal property taxes. Frequently the rate to foreigners operating interstate is greater than to home-state truckers operating intrastate. In some parts of the country, these restrictions make long hauls through several states prohibitive. Often they greatly limit traffic between neighboring states.

In order to collect the motor trucks taxes and license fees required by some states, it has been necessary to establish ports of entry along the main highways leading into the state. Here state customs are collected by state custom officers, much the same as import duties are collected along the borders of the many little states in Europe.

Kansas, the first state to establish a port of entry, now maintains 66. Oklahoma, Nebraska, Arizona, New Mexico, California, Idaho, Utah and Colorado have retaliated. Many eastern states have withstood the temptation to set up ports of entry along their borders only because of the certainty of retaliation by all of the states bordering them.

The entire cost of operation of the port of entry system, plus the tax revenue collected and loss of time, must come out of the cost of distribution at the expense of the consumers



Courtesy of U. S. Public Roads Administration

The "private carrier" truck fleets of the food manufacturers are the largest group of trucks using the highways today. The many restrictions and taxes placed on them restrict free trade and materially increase the cost of distribution. If the laws now enforced in some states are permitted to spread to other states and are rigidly enforced, food manufacturers must abandon their own fleets. It will then not be lawful to operate them.

through higher prices. The states have found a way of doing that which is permitted by the Constitution to the Federal Government alone. The states have found a way of deflating United States currency within their own borders.

State laws which restrict the free flow of internal trade transported by common or contract carriers over water, rails or highways, increase the cost of raw materials and the cost of distribution. They shrink the food manufacturers' market. All food manufacturers are affected by any and all legislation regulating transportation.

No other industry stands to lose so much from transportation barriers to free trade as the food industries. Particularly is this true of private carrier legislation. The food manufacturers are the largest users of their own (private carrier) fleets, (see Table I and II). If the laws adopted by some states are extended to other states, the existence of many food manufacturers will be seriously threatened.

The state of Texas has passed a truck transportation regulatory law known as the "Certificate and Permit" law. (House Bill No. 335). This law requires all common and contract carriers to obtain a certificate of public convenience and necessity and a permit to engage in the business of transporting merchandise over the highways. The law by a "shot-gun clause" includes as common carriers "all others hauling for compensation or hire." Thus, in Texas the trucks of the food manufacturer, meat packers, dairy products manufacturers and brewers are common carriers and must qualify for and obtain certificates of convenience and necessity and permits to operate as common carriers. The courts have maintained in two cases that no matter whether producers make a differential charge for deliveries in their own trucks or whether the cost of delivery is included in the price of the merchandise, producer's trucks are operated for hire and compensation and therefore must obtain common carrier permits.

The unfortunate situation for the food manufacturer operating his own truck is that although Texas law stipulates that common carrier permits can only be issued by the Texas Railroad Commission, the law forbids the issuance of common carrier permits if

granting the same "would impair or hinder the operation of any then existent common carriers," either railroad or motor freight line. Hence the Railroad Commission will not—in fact cannot—issue permits for the operation of the manufacturer's own trucks.

Texas "shipper-owners" are caught between the mandate of the courts that they obtain a contract carrier permit from the Railroad Commission, and the statute prohibiting the Railroad Commission from issuing that permit.

A somewhat similar law has recently been enacted in Oregon.

The present transportation laws of the various states are barriers to free trade and as such restrict the competition of the food manufacturer and increase the cost of distribution. They serve to limit the market of every food manufacturer. Restrictions of these state laws on motor truck transportation will continue to burden the trade of the food manufacturer until some means is found for removing many of them and standardizing those that remain so that there is uniformity of regulation from state to state (see Appendix).

It should be significant to food manufacturers, who advocate keeping the government out of business, that the means used to remove state barriers set up to restrict the free flow of trade over the railroad, was to regulate them by the Federal Government's Interstate Commerce Commission. If industry does not wish more federal control in removing the barriers to free trade, let them turn to their own good public relations.

Appendix

Gross Weight, Dimensions and Speed for Vehicles Operating on the Highways

Adopted by the American Association of State Highway Officials in Convention at Washington, D. C., Nov. 17, 1932, and recommended for adoption by all states.

It is the opinion of the Association that the adoption of a uniform standard to govern gross weight, dimensions and speeds for motor vehicles operating on the highways is a fundamental necessity for the following reasons:

(*a*) To establish one of the fundamental prerequisites of highway design.
(*b*) To promote efficiency in the interstate operation of the motor vehicle.
(*c*) To secure safety in highway operation.
(*d*) To remove from the highways undesirable equipment and operation.
(*e*) To stabilize on a definite basis the many relationships between the highway and the motor vehicle.

These conclusions have been reached after many years of consideration on the part of the Highway Transport Committee of the Association supplemented by painstaking research by a number of the State Highway Departments and the Bureau of Public Roads.

The Association therefore makes the following recommendations to the proper state authorities having control of traffic on the highways:

(1) WIDTH—No vehicle shall exceed a total outside width, including any load thereon, of 8 ft., except vehicles now in operation which, by reason of the substitution of pneumatic tires for other types of tires, exceed the above limit.

(2) HEIGHT—No vehicle unladen or with load shall exceed a height of 12 ft., 6 in.

(3) LENGTH—(*a*) No vehicle shall exceed a length of 35 ft. overall dimensions, inclusive of front and rear bumpers.

(*b*) Combinations of vehicles shall consist of not more than two units and, when so combined, shall not exceed a total length of 45 ft.

(*c*) The truck tractor and semitrailer shall be construed to be one vehicle for determining lengths.

(*d*) For occasional movements of materials or objects of dimensions which exceed the limits herein provided, a special permit shall be required.

(4) SPEED—(*a*) Minimum speed. No motor vehicle shall be unnecessarily driven at such a slow speed as to impede or block the normal or reasonable movement of traffic except when reduced speed is necessary for safe operation or when a vehicle or a combination of vehicles is necessarily or in compliance with law proceeding at reduced rate.

(*b*) Maximum speed. No bus or truck shall be operated at a speed greater than 45 miles per hour. Passenger automobiles may be operated at such speeds as shall be consistent with safety at all times with safety and the proper use of the roads.

(*c*) Vehicles equipped with solid rubber or cushion tires shall be operated at a speed not in excess of 10 miles per hour.

(5) AXLE LOAD—(*a*) Wheels of all vehicles, including trailers, except those operated at 10 miles per hour or less, shall be equipped with pneumatic tires.

(*b*) No wheel equipped with high pressure, pneumatic or cushion tires, shall carry a load in excess of 8,000 lb., or any axle load in excess of 16,000 lb.

Research indicates that low pressure pneumatic tires can carry 9,000 lb. per wheel without increasing pavement slab stresses.

An axle load shall be defined as the total load on all wheels whose centers may be included between two parallel transverse planes 40 in. apart.

(*c*) These limitations are recommended for all main rural and intercity roads, but should not be construed as inhibiting heavier axle loads in metropolitan areas if any state desires.

(*d*) These weight specifications for wheel and axle loads may be restricted by the State Highway Department for a reasonable period when road subgrades are materially weakened from thawing after deep frost or from a continued saturated condition of the soil.

(5) GROSS WEIGHTS—Subject to the limitation imposed by the recommended axle loads no vehicle shall be operated whose total gross weight, with load, exceeds that given by the formula $W = c(L \text{ plus } 40)$ where

W = total gross weight, with load in pounds

c = a coefficient to be determined by the individual states

L = the distance between the first and last axles of a vehicle or combination of vehicles, in feet

A value of 700 is recommended for "c" as the lowest which should be imposed but this should not be construed as inhibiting greater values.

Note—This gross weight recommendation is particularly applicable to bridges since axle loads and length limitations are determinative in their practical application.

EDITOR'S NOTE—*Adoption of these standards by all states would eliminate most of the transportation barriers to interstate trade.*

Table I—Distribution of Truck Fleets of Eight or More Units[1]

Types of carriers	Number of trucks	Per cent of total
Government, state, county, municipal	230,374	24.2
Common and contract carriers (Hauling inter and intra state)	162,095	17.4
Railroad and public utilities	74,248	8.0
Private carriers	462,780	49.8
Total	929,497	100.0

[1] *Compiled from 1939 edition of "Automobile Facts and Figures."*

Table II—Distribution of Private Carriers with Truck Fleets of Eight or More Units

Fleet owners	Trucks	Per centage of private carriers
Food manufacturers	182,566	39.5
All other manufacturers	175,937	38.0
Service institutions	91,994	19.8
Miscellaneous	12,283	2.7
Total	462,780	100.0

Hints and Hurdles

Must Have Been the Heat

IN THE FEDERAL REGISTER for Aug. 15, under "Suggested Findings of Facts" for canned vegetables, we read the following: "That the canned vegetable which is commonly known as sweet potatoes is the food prepared by packing in a container the immature, succulent vegetable commonly known as sweet potatoes . . . That canned bean sprouts is the food prepared from the immature succulent sprout of the Mung bean . . . That canned beet greens is the food prepared from the immature, succulent leaves or such leaves and the immature root, of the succulent vegetable commonly known as beets . . . That canned broccoli is the food prepared from the immature succulent heads of the broccoli plant . . . That canned cabbage is the food prepared from cut pieces of the immature, succulent heads of the cabbage plant . . ." and so on indefinitely.

It sounds to us like a passage from the books of chivalry read in our youth, when knights and ladies of the court feasted on succulent young pigs—when mounted knights in armor bore down on each other, bashing lance on target, unhorsing each errant over his horse's tail, only to hurl each other at each other with drawn swords and with mighty blows to cleave each other asunder.

And suddenly we are aware that the hot afternoon sun is beating in on us at our desk and we realize we are getting a bit "tetched in the head." And then from the top of the pile of "releases" on our desk, this smacks us between the eyes as a flash of summer lightning, "Delicious cheese flavor photographed" and we read it again and wonder if all cheese flavors have been photographed or just those that are "delicious." And we try to imagine a photograph of the flavors and the aromas of a Christmas dinner but the kaleidoscope of futuristic design becomes so intricate, we become confused and so we turn again to the release and read, "Cheese flavor has just had its picture taken for the first time. Scientists are using X-rays to photograph the flavor of cheese. They want to find out what gives cheese its delicious flavor." And then we think of some wives we know and how a photograph of the flavor of Limburger cheese would appear to them—as a hideous nightmare. Why not photograph nightmares, and for that matter D.T's. and —gosh, it is hot!

Let's Educate the Consumer

EDUCATORS today are less concerned with teaching beginners the three Rs than with the greater problem of adult "consumer education." The problem is bringing gray hairs to many a business man—to many an industrialist. The program of the conventions of food associations would indicate that the "consumer" is a major worry of food manufacturers.

"Educating the consumer" and "consumer education" both imply consumer ignorance. They label the consumer "dumb," and yet only recently a news release announced the "discovery" of the vitamin and mineral value of "pot liquor." Even dumb consumers among the underprivileged third don't waste pot liquor.

The census of manufactures accounts for approximately 50,000 food manufacturers (estimate high). That means one food manufacturer to each 26,000 consumers—a lot of pupils per teacher. Numerically, it would appear simpler for 26,000 consumers to educate one food manufacturer. However, it is just possible that the educators are right in their determination to educate consumers.

Another new paper milk bottle machine has recently been placed on the market. The machine is small and composite. It forms paper bottles from cardboard blanks, automatically paraffins and cools them, fills them with milk, seals and delivers them to cold storage. The economic battle between glass and paper milk containers is being waged on an ever widening front.

Old and new package designs employed by McCormick & Co. In each of the three groups of packages, the old design appears on the right, with the new design beside it, on the left.

New Packages & Products

Improved Containers Avoid Package Errors

FOR a number of months FOOD INDUSTRIES has published long lists of packaging "don'ts." Most of these were actual mistakes made by food manufacturers in the past, generously contributed to aid food manufacturers in avoiding costly packaging mistakes in the future.

The packages shown on this page have been recently developed. In developing these packages, McCormick & Co., Baltimore, has avoided many of the costly mistakes pointed out in the packaging "don'ts."

The idea of improving containers, packages and labels of McCormick products originated with the company employees. From them, also, came many suggestions as to how to improve the line. Each suggestion was considered by a committee made up of management and employees. Any accepted change had to meet the approval of producing, accounting, sales and advertising departments. Consumers were consulted also. Some 1,500 of them were asked for their criticisms of the old packages and given a chance to express approval of each proposed change.

As each improvement was accepted it was applied to one product or one member of a family group. Material and production costs were checked against sales increases before the package improvement was adopted for other products or other members of a family. Final design and color results passed through the clinic of an outside designer. This type of cross-checking and testing has proved economically sound. The fact that employees were consulted has created an enthusiasm for improvement and modernization.

The broad base of the extract bottles with indentations on the side are improvements which resulted from consumer criticism. The color combination, white and dark green, on a red-orange background, has tested and proved shelf visibility far above that of the former color combination. Partly, this visibility is the result of simplicity of design and the removal of unnecessary elements on the label. The effect of simplicity is clearly apparent in the substitution of the short, composite "Mc" for the long, difficult to grasp lettering required for "McCormick's."

McCormick & Co. has replaced the old fashioned top-heavy extract bottle with a modern container; broad at base, sturdy and tapering. To prevent the bottle sliding out of slippery hands, indentations for the fingers are placed on the sides.

Food DISTRIBUTION

More Mistakes To Avoid in Packaging

PART VIII

EDITOR'S NOTE: ***This series will run for several months until it is completed***

EVERY EXAMPLE is based on actual errors of packaging. Publication of the negative aspects of packaging is frequently more informative than the mere statement of a bunch of rules to follow. Particularly is it important to bring out the reasons why, and the automatic penalties that develop because of making mistakes.

234 **Insufficient Care in Planning**—Manufacturer of nationally known food products packed in bottles redesigned one item in his line, and planned national advertising to break at the time of introduction of the new package. At the last minute, serious difficulties were met due to the fact that the new bottles could not be handled on the existing machinery. You see, the size of the new bottle varied slightly from the old.

235 **Variations in Container Size**—A food manufacturer complained that the capping machine was breaking his bottles during capping. Upon investigation, it was disclosed that some of the bottles were coming in oversize from the glass manufacturer, resulting in a failure of the bottle to fit the proper part during capping. This caused crushing of the bottle.

236 **No Control Over Hand Packing**—Improper control or absence of any control of hand operations preceding an automatic wrapping machine is an error. Best results are secured when hand packing operations are kept within control to prevent bulging packages, over-filled or under-filled packages or cartons packed out of square. Simple standards of performance to provide for properly packed and properly closed packages will make for greater efficiency, less spoilage, and better wrapped packages when using automatic wrapping machines.

237 **About Packaging Machinery**—Do not build a package to suit a machine. Machinery is the cheapest tool you can have if you use it. The big thought is not how cheap you can buy a machine, but how low you can make your packaging costs. Do not buy second-hand machinery because it is convenient. Do not be sold some machine that alters your scheme of packaging. Have a good plan and stick to it, and get the machinery to suit. Have the machinery suit your package, not your package suit the machinery.

238 **Allowing Cross-Contamination** — In manufacturing a varied line of salad dressings, the maker discovered that, although the pipe lines connecting the filling equipment with the supply tank were of sanitary piping, they could not be sufficiently cleaned by flushing with hot water to prevent cross-contamination of the several different products. Consequently, this plant was compelled to use the installed pipe lines for but one of the products, installing hose lines to accommodate the other products.

When liquid filling equipment is used to handle several products it is always best to use hose lines where regulations permit it, rather than permanent piping. Even with sanitary piping, the pipe is much more difficult to clean than the hose. Many materials leave a deposit which hardens enough to make cleaning difficult unless the pipeline is taken apart and brushed out, which is a more expensive procedure. Hose is less expensive in first cost, so that when several products are used, individual hose lines can be employed for each product, thus avoiding cross-contamination of one product with another.

239 **Rough Handling Made "Soup"**—A canner of tomatoes was very careful in the selection and preparation of the raw product and likewise was processing the cans in such a manner that a very good quality pack resulted. To save labor in trucking the processed cans to the warehouse for subsequent air cooling, this canner next installed a gravity-feed can runway to the warehouse. The hot cans of tomatoes necessarily rolled about 350 ft. through several twists, drops and stops. Upon reaching the warehouse, the tomatoes were veritably soup, whereas samples taken at the end of the process, and not roughly handled until thoroughly cooled, were of excellent quality.

240 **Off Flavors at Start of Season**—A pea canner had been experiencing a peculiar off flavor in canned peas packed on the first day of each season for three or four consecutive years. It was found that his engineer in preparing for the season's pack had been painting a float in his boiler feed-water heater with a "rustproof" material. Investigation disclosed the fact that the "rustproof" material was none other than disinfectant for his silage stack.

241 **Cartons Wrong Size for Cans**—Cartons for cans must be very carefully proportioned with two thoughts in mind: (1) They must fit loosely enough to permit automatic packing. (2) They must fit tightly enough to prevent the cans from shifting in such a manner that the bead of one will damage the body or scuff the label of another. In the case of too loose a fit, the bead of one can may ride up over the bead of an adjacent one. Thus in handling on conveyors, on trucks and in freight cars,

the joggling will seriously dent many of the cans. The injury is particularly harmful in the case of beer, where the lining inside the can may be broken. And it renders any can unsightly in appearance.

But if the carton is too small, it may be impossible to get the cans into it on an automatic caser. Therefore it is necessary to design the carton as small as possible and still permit automatic packing.

242 **Overfilled Containers**—A customer was advised to pack only 7 lb. of apple sauce into No. 10 cans. However, cans were filled with 7 lb. 2 oz. to 7 lb. 4 oz. This resulted in soft swells due to overfilling, and also spoilage due to the adding of cooler apple sauce to the normally filled cans. This cooler apple sauce was not sterilized by the process as the overfill of the can did not permit agitation of the contents.

243 **Wrong Inside Enamel**—Although advised that "C" enamel cans were unsatisfactory for sauerkraut, one packer used "C" enamel cans for this product with the result that the sauerkraut removed the enamel and made the canned product unmerchantable.

244 **Raised Temperature, Corn Spoiled**—Although advised that processing at 240 deg. F.—not 250 deg. F.—should be used for No. 10 cans of whole kernel corn, because the internal pressure developed by this product, as it was packed, would strain the can and cause leakage, a temperature of 250 deg. F. was used. Strained cans which leaked, resulting in considerable spoilage, were the consequence.

245 **"Special" Pack Backfires**—A grapefruit canner prepared some samples of his product in No. 5 containers, taking care that only perfect sections were carefully packed in the cans and that the process used was a "minimum" one. Some samples were sent to a broker who later placed an order with this canner. The order was filled with grapefruit commercially—not specially—packed, and when received by the broker was rejected because the delivered product did not meet the specifications of the samples.

Do not prepare special samples to represent merchandise for sale.

246 **Cartons Wrong Height for Bottles**—When fiberboard containers for bottles are purchased, it is necessary that the buyer keep in mind the problem of stacking. Sometimes containers have flap covers that clear the tops of the bottles by more than $\frac{1}{8}$-in. When such containers are stacked, the whole weight of the stack is on the container instead of the bottles. So the containers are crushed.

Open-top fiberboard containers must be exactly the same height as the bottles. If the weight of the stack comes on the container instead of bottles, which would occur when the container is higher than the bottle, the container will be quickly ruined. If the weight of the stack comes on the tops of the bottles only, and the container is shorter than the bottle, it makes a very unstable stack with a tendency to tip over.

The bottle must carry the actual weight of the stack, but the size of the container must be exactly the same height as the bottles so as to steady the stack.

247 **Wrong Pick Up Gum Temperature**—In many cases a hot pick-up gum is used when labeling, with a simple electrical heating unit in the cement pot, equipped with a three-position switch: hot, medium, and off. Under such conditions the adhesive is often too hot or too cold; rarely the right temperature. Yet, for a modest expenditure of money, a thermostatic control could be installed that would definitely pay dividends.

Removing labels and relabeling is much more expensive than a little attention to details.

248 **Shook Samples—Blamed Cooker**—A canner of grapefruit was complaining about a continuous cooker in that the sections or segments of grapefruit were considerably broken at the end of the process. A representative of the manufacturer of the continuous cooker found nothing wrong except that all samples showed considerable breaking down of the grapefruit segments. After three or four days of exasperating study, it was discovered that all samples examined were taken from the line by the canner himself, who had previously canned corn in a North Central state. As was his corn-canning custom, he unknowingly shook each can prior to opening, thus causing the break-up of segments. When the canned grapefruit was treated gently, it was found that the segments were whole and in a perfectly satisfactory condition.

249 **Not Air Tight? Not Moisture Tight**—A package that is not air tight is not moisture tight. A product that has "normal" moisture content i.e. is in equilibrium with atmospheric moisture content, is least hazardous in regard to taking on or giving off moisture or odors. Moisture-proofness is not identical with moisture-tightness. A material or a package which itself is not injured by moisture is moisture-proof, even though it may permit the transfer of moisture vapor like a sieve. In fact, a metal sieve package would be moisture-proof but not moisture-tight.

To be moisture tight a package must be both moisture proof and air tight to prevent moisture vapor transfer and "barometric pumping." Yet with some materials the moisture may even get through an airtight package apparently by solution in the material itself.

250 **No Idea of Directional Strength**—A manufacturer of products packed in folding boxes was having his troubles because of crushing of contents in transit and storage. These contents were such that they had to be packed in a box, roughly the shape of a brick, but with the opening at the small end.

The boxmaker had furnished containers with the corrugations running in the usual direction, namely from top opening down to bottom opening. But, in stacking this container, the freight handlers invariably laid it on its side so that the corrugations were horizontal instead of vertical. In this position they provided no resistance whatever to stacking loads. The condition was rectified by the extremely simple method of running the corrugations the short way of the box, so that they were vertical when the boxes were laid on their sides.

Food Technology

NEW DISCOVERIES & INVENTIONS

CANNING & PRESERVING

Preventing Blackening of Canned Crabs

THE EDIBLE BLUE CRAB (*Callinectes sapidus*) occurs in vast numbers in the shallow coastal waters of the Atlantic and Gulf States. The United States produced 11,000,000 pounds of fresh crab meat in 1936 and imported 11,157,000 pounds of canned king crab meat from Japan in 1937. The markets for the fresh meat are limited to the coastal cities by the poor keeping quality of the fresh meat. Past efforts to preserve the crab meat by canning have failed because of serious color and flavor defects.

In the new successful method, the live crabs are steamed, eviscerated, and the meat picked by hand from the claws and body. Next, the meat is dipped in a protective brine containing, besides sodium chloride, small amounts of aluminum salts and lactic acid. The meat is then drained, packed into parchment-paper-lined cans, sealed under high vacuum, and finally given a thermal treatment of 250 deg. F. for 30 minutes. The canned product retains fully the characteristic color and flavor of the fresh meat.

The cause of the discoloration in the untreated canned crab meat is the copper present in the hemocyanin of the crab's blood. The blood contains 60 p.p.m. and the flesh 2 to 6 p.p.m. of copper. However, the latter small amount is sufficient to produce an unsightly blue discoloration in the canned meat. The reduced form of hemocyanin is colorless; the oxidized form is blue. The copper linkage is loose and copper is readily liberated. A further complication is the formation of blue-to-black colored-ammonia complexes. Ammonia is liberated by heat from the rather unstable crab protein. These facts indicate the complexity of the problem. The exact nature of the reactions has not been fully worked out, but it has been amply demonstrated that the protective action of aluminum and/or zinc salts is quantitative, consistent, and permanent. Aluminum is preferred to other possible metallic salts, not only because of its excellent protective properties, but also because it presents no health hazards and its use is free from official and popular objection, provided label declaration is made.

Digest from "Canned Atlantic Crab, a New American Food," by Carl R. Fellers and Sterling G. Harris, Massachusetts State College. Presented at American Chemical Society, Boston meeting, Sept. 11–15, 1939.

DAIRY PRODUCTS

Shorter Curing of Blue Cheese

BLUE CHEESE made from cows' milk takes from six to twelve months to develop the characteristic Roquefort-type flavor. By adding the commercial enzyme, steapsin, to the milk or to the curd before hooping, at the rate of 1 gram per 100 pounds of milk, the cheese developed the characteristic flavor in under five months while control cheese required over a year. The steapsin cheese was accepted by the trade but experts noted a slight bitter flavor. Failure to inoculate the cheese with the mold *Penicillium roquefortii* and using steapsin produced a very rancid flavored cheese with no blue cheese flavor.

Digest from "The Use of Steapsin in the Manufacture of Blue Cheese," by S. T. Coulter and W. B. Combs, *Journal of Dairy Science*, 22, 521, 1939.

BEVERAGES

Pasteurizing Beer

AN INVESTIGATION was undertaken to determine the thermal death time of a representative number of common micro-organisms which may be encountered in a brewery.

Twenty-one cultures were selected for study. Of these, seventeen were apparently pure as based on repeated plating procedures. The apparently pure cultures consisted of five *Sarcina* (*Pediococcus*) strains, two *Lactobacillus* strains, two *Acetobacter* strains, and eight yeasts. The other four cultures consisted of (1) a strain of *Lactobacillus* taken directly from a markedly turbid, pasteurized, light bottled beer, (2) mixed cultures as existing in (a) infected storage ale, (b) infected storage beer, and (c) spoiled draft beer.

The sources of the pure cultures were brewing materials and contributions from the American Type Culture Collection and Dr. A. J. Kluyver, Technische Hoogeschool, Delft, Holland.

The results of the studies indicated that the standard practice of pasteurization at 140 deg. F. for 20 minutes should render beer and ale free of all living micro-organisms commonly encountered in the brewing industry. None of the bacteria or yeasts studied was able to survive an exposure to 60 deg. C. (140 deg. F.) for 10 minutes. Yeast spores were killed within 20 minutes at 58 deg. C. (136 deg. F.) and within 15 minutes at 60 deg. C. (140 deg. F.).

Digest from "Thermal Death Time of Micro-organisms Encountered in the Brewing Industry," by Samuel S. Epstein and Foster Dee Snell, Foster D. Snell, Inc., 305 Washington St., Brooklyn, N. Y. Presented at American Chemical Society, Boston meeting, Sept. 11–15, 1939.

MILLING & BAKING

Bread Dough and Better Loaves

THE ADDITION of a protease (such as papain) or of glutathione (which occurs in wheat germ) to a dough, which would otherwise give a normal loaf of bread, produces bread of low volume and poor quality. The effects of protease or glutathione may be overcome and normal bread again obtained either by adding the proper amount of an oxidizing agent, such as potassium bromate, or by mixing the dough in oxygen. The improvement is greater the lower the grade of the flour. The addition of too much bromate produces a poor, low volume loaf, giving the "excess bromate" effect. This may be overcome and

(*Turn to page 582*)

Formulas for Foods

Canned Smoked Oysters

By P. A. SUNDERLAND

Pacific Fisheries Experimental Station, Prince Rupert, B. C.

FORMULA NO. 6

TWO or three years ago there appeared in the retail market in Canada, canned smoked oysters from Japan. These were packed in a salad oil in ¼-lb. drawn oblong sardine cans. This product was of a dark brown color and not at all attractive in appearance. The idea occurred to the Research Department of the American Can Company in Portland, Oregon, that this type of product might be an outlet for Pacific coast oysters. They obtained fresh oysters from the Willapa Bay district in the State of Washington, and as a result of their experiments two or three canners in the area referred to placed canned smoked oysters on the market. Although the imported Japanese product had developed considerable importance in the specialty trade on this coast, the American article has generally been recognized as possessing a better quality, with a more pleasing flavor and appearance. The improvement in flavor no doubt is partly due to the fact that the crab-apple wood used in the American smoking process is recognized as producing excellent flavors.

At the request of a British Columbia firm, the writer carried out some experiments in the smoking and canning of Pacific oysters, using the controlled smokehouse installed at this station last year and designed principally for cold smoking of fishery products such as kippered herring and fish fillets. A fine smoked flavor could be imparted to oysters in a very short time when they were smoked at temperatures between 70 deg. and 80 deg. F., but a sufficiently brown color could not be produced. A higher temperature was required to develop the desirable color and also to dehydrate them to such a degree that the final product would appear attractive in the can. It became necessary, therefore, to add an accessory heating unit so that smoking could be carried out at higher temperatures. This was accomplished by installing inside of the recirculation pipe a series of electric heaters capable of raising the temperature in the smokehouse up to 140 deg. F.

It was found that the best method for opening the oysters was to steam them in a retort for 30 min. at 240 deg. F. This treatment not only caused the oysters to open up but also dried them out to such a degree that the flesh could be removed easily and handled without causing it, particularly the mantle portion, to adhere to the shells. When they were allowed to remain longer in the retort during this preliminary treatment the mantle became dry and hard and actually adhered to the shells, resulting in some loss in weight as well as marring the appearance of the product.

After opening, the oysters were well rinsed in a 10 deg. salinometer brine (2.5 per cent salt by weight). This treatment was quite essential in removing all particles of sand and grit and at the same time lightly salted the product. All washing was completed within five minutes, after which the oysters were spread in a single layer on ½-in. mesh galvanized wire trays previously oiled with cooking oil to prevent them from adhering to the wire.

It was found advisable at this stage of the preparation to carry out the work as quickly as possible, so as not to allow the oysters to come in contact with air unnecessarily, as this will cause them to turn dark. Contact with air also toughens the oysters and gives them an unsightly appearance. For the same reason the smoke-

(*Turn to page 584*)

Solubility Chart for Certified Food Colors

FORMULA NO. 7

Where certified colors are used in foods, it is an important aspect of quality control that the color of the food be kept uniform. Yet, because of the variable solubility of the colors themselves and their varying solubilities at different temperatures, it is highly important that the standard color solutions be prepared and maintained with the foregoing principle in mind.

The following chart prepared by the laboratories of Wm. J. Stange Co., Chicago, is useful to anyone who is concerned with formulas or quality control.

Solubility Chart for Certified Food Colors

Degrees Fahrenheit

	Freezing	40	50	60	70	80	90	100	110	120	130
PONCEAU 3R	6.2	10.9	13.6	15.1	16.7	17.9	19.1	20.3	21.5	22.5	22.8
ORANGE I	1.5	1.9	2.2	2.5	2.7	3.2	4.0	5.0	8.6	13.2	17.5
TARTRAZINE	5.9	6.2	8.1	10.3	14.9	21.4	35.3	41.5	45.9	48.8	49.9
AMARANTH	3.1	12.1	17.7	20.9	22.9	26.0	28.2	30.4	31.9	33.6	35.3
GUINEA GREEN	12.0	18.0	24.0	30.0	33.2	36.0	38.4	42.2	46.0	48.6	51.2
FAST GREEN	12.0	18.0	24.0	30.0	33.2	36.0	38.4	42.2	46.0	48.6	51.2
ERYTHROSINE	5.0	6.2	7.4	8.6	10.	11.4	12.8	14.4	16.0	17.6	19.3
INDIGOTINE	.8	.9	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.8
SUNSET YELLOW	9.2	23.0	28.0	30.9	33.7	35.6	37.4	39.2	40.9	42.6	43.8
PONCEAU SX	1.25	2.5	5.0	7.4	8.6	9.8	10.4	11.0	11.5	11.8	12.1
NAPH. YELLOW	10.9	12.1	13.2	14.3	16.0	17.7	20.3	23.0	26.0	29.5	32.8
LIGHT GREEN	Very soluble. 25% will remain in solution even at freezing.										
BRILL. BLUE	Very soluble. 32% will remain in solution even at freezing.										

This chart indicates the number of ounces of color which will remain in solution in distilled water to make a gallon of finished liquid at a given temperature. In dissolving the above colors, the solution must be heated at least 50 deg. F. higher than the chart indicates.

The Food Industry News

Important Points Argued At Hearing on Preserves

On Sept. 11, the Department of Agriculture began hearings on proposed standards of identity for fruit preserves, fruit jellies and fruit butters. Presiding officer M. F. Markel quickly discovered that he had an elaborate and protracted proceeding on his hands.

Government witnesses undertook by a most literalistic interpretation to support the original proposals of the standards. It was evident, however, that not one of them nor their attorney was in sympathy with the idea that a standard of identity take the place of complete declaration of all ingredients on the label.

The preserve industry itself supported most of the Government's proposal in the original standards. It did request, however, the elimination of black currant from the list of fruits and was supported by the Government men in that particular. The principal objection offered by the preservers to the original standards was that in mixed fruit materials it was often not practical from the trade point-of-view to make the minor fruit component equal to 40 per cent of the total fruit.

Vigorous opposition was expressed by industry spokesmen to one detail of labeling jellies with such names as "dried apple jelly" or "dried peach jelly." It was pointed out that a uniform year-around manufacture is possible only if specially prepared dried or evaporated fruits are used. The result is, industry men stated, a better, more uniform, cheaper and equally acceptable product which cannot be distinguished from the product made during a short season from fresh fruit only.

The controversy over the use of added pectin and added acid to improve the consistency of preserves, jellies and butters was at times acrimonious. The major difficulty appeared to be in securing some method of defining how much of these corrective agents could be added without making the product of lower quality or deceptive to the purchaser. Even the Government witnesses admitted that such addition agents were necessary to get first-quality products, but insisted on label declaration. The industry opposed the latter when only very small additions were made to bring the quality of acid and pectin up to that normal for fruit in optimum condition for preserving. That, they said, was merely to correct Nature's faults, not to deceive the public.

The whole sugar controversy between cane and beet on one side and corn sugar on another went along much the same course as during earlier hearings. That controversy was, however, almost overshadowed by a new one. Liquid sugar makers were present to argue that clarified sirups made from raw sugar, high-grade molasses or other sucrose products not as pure as the ordinary refined cane sugar were both proper and desirable. This argument created new difficulties for the cane and beet producers and refiners and diverted the attack away from dextrose and corn sirup.

Government witnesses evidenced considerable desire to prevent altogether the use of these lower purity sucrose products in true preserves and jellies. Quite in contrast with that attitude, they exhibited no desire to prevent the use of either dextrose or corn sirup in reasonable quantities provided label declaration was made. It becomes evident that much of the cane-corn controversy is a matter of label discussion, not at all a question of the propriety of using these demonstrably wholesome and proper components of the manufactured foods.

ON ADVISORY COUNCIL

Thomas E. Wilson, chairman of the board of Wilson & Co., Chicago, and head of the National Livestock and Meat Board, is one of the members of the Agriculture Advisory Council appointed by Secretary Wallace. Herman Fakler, vice-president of Millers National Federation, is also on the council. This new advisory body was established to assist the government in formulating policies for production, distribution and marketing of foodstuffs under conditions expected to result from the European war.

Standards for Peaches Proposed by Government

Suggested standards of identity for canned peaches were published in the *Federal Register* of Sept. 7. Suggested standards for canned apricots, pears and cherries have not yet been issued.

The canned peach standards, if officially adopted, would require label declaration of kind and color of peach, size or shape of pieces in the can, type and components of liquid in which the fruit is packed and the presence of peach pits or kernels, flavoring, spices or vinegar. Either sucrose alone or a mixture of sucrose and dextrose may be used, but label declaration of both is required.

Great disappointment is expressed by many industrial spokesmen because of the complicated labeling requirements. In one example, wherever the word "peaches" appears, it must be accompanied by over 30 other words modifying it. Such "simplification" of present labeling is scarcely consistent with the purpose of establishing a standard of identity. It is not expected to meet with the approval of the Secretary.

Suggested standards of quality and fill of container for canned peaches were published in the Sept. 15 issue of the *Federal Register*.

Two Wage-hour Rulings

Wage-hour Administrator Andrews has granted partial exemption from the hour provisions of the Fair Labor Standards Act for handlers of English walnuts in California, Oregon and Washington. Mr. Andrews on Aug. 28 issued a preliminary finding declaring that the receiving, grading and packing of English walnuts is a branch of an industry of a seasonal nature. Under the exemptions, employees may work up to 12 hours a day or 56 hours a week, without overtime pay, for a 14-week period.

Another ruling by Administrator Andrews holds that the ice cream industry is not exempt from the maximum hour provision of the wage and hour law. The processing involved in the manufacture of malted milk, ice cream mix, ice cream and ice cream novel-

ties does not constitute the first change in the form of the raw material and therefore is not exempt from the wage and hour law, the ruling stated.

French Name U.S. Buyer

War-time purchases made in the United States by France will clear through the offices of Maurice Garreau-Dombasle, commercial counselor to the French Embassy, 610 Fifth Ave., New York. Information on the available supplies of various foodstuffs and on all types of products eligible for shipment under the Neutrality Act are being gathered by this office. All quotations and bids must be sent to the office by mail.

European Nations Change Food Import Regulations

In the first three weeks following the outbreak of war in Europe, several changes were made in food import regulations by European nations. Great Britain has prohibited imports of certain goods except under license to conserve exchange for the purchase of other war materials. The foods affected are fresh fruits (other than apples, pears, bananas, grapefruit and limes), honey, nuts, canned vegetables (other than tomatoes), fresh vegetables (other than potatoes, tomatoes and onions), fruit juices, hops and licorice.

On Sept. 7 the British Board of Trade suspended all orders imposing quota restrictions on imports of bacon and ham. This, however, does not mean unlimited entry, as the government has plans for complete control of foreign trade.

France suspended temporarily (until Sept. 30) the payment of import license taxes on frozen mutton, pork, beef and other imported meats.

Italy has subjected exports of 58 products to license control to protect domestic supplies of essential commodities. Among the products affected are fats (including olive oil) and various food products, including almonds, walnuts, hazelnuts and lemons.

Holland has established complete control over imports and exports of a wide variety of farm products and derivatives. The commodities affected include cereals, cereal products, legumes, potatoes, oil seeds, animal meal, milk and dairy products, animal oils, fats, livestock, meat products, poultry products, fish, fruits and vegetables.

Britain Centralizes Buying

Sole authority over the importation of all essential foods into Great Britain has been invested in the British Food Defense Department, to be known in the future as the Food Ministry. It is understood that centralized buying will be adopted for important staples. The plans are still incomplete, but it is expected that the British will purchase the better part of a year's supply of all essential food imports while prices overseas are still reasonable. The matter of actual delivery, however, is to be deferred until the products are needed, and as the shipping situation permits their movement.

Acme

SUGAR SHIPMENTS INCREASE

After skyrocketing prices prompted President Roosevelt to drop the quota restrictions on sugar imports, such scenes as this became common at eastern ports. The picture shows a sample of raw sugar being taken by a customs inspector on a dock at Philadelphia. Simultaneous with the removal of the quota limitations, the duty on Cuban sugar became 1½ cents a pound. Previously Cuba had enjoyed a tariff preference of 0.9 cent. President Roosevelt acted on authority granted by the Jones-Costigan Act.

CONVENTIONS

October

2–3—Eleventh Boston Conference on Distribution, Boston, Mass.
2–4—United States Brewers Assaciation, Waldorf-Astoria Hotel, New York.
4—United Brewers Industrial Foundation, Waldorf-Astoria Hotel, New York.
4–6—American Oil Chemists Society, Stevens Hotel, Chicago.
9–11—National Association of Food Chains, Drake Hotel, Chicago.
12–13—Packaging Institute, Inc., Edgewater Beach Hotel, Chicago.
15–19—American Bakers Association, Commodore Hotel, New York.
15–19—Master Brewers Association of America, St. Francis Hotel, San Francisco.
16–20—National Safety Congress and Exposition, Atlantic City, N. J.
17–20—American Public Health Association, William Penn Hotel, Pittsburgh.
23–25—International Association of Ice Cream Manufacturers, St. Francis Hotel, San Francisco.
23–28—Dairy Industries Exposition, San Francisco.
25–27—International Association of Milk Sanitarians, New Hotel Mayflower, Jacksonville, Fla.
26–28—International Association of Milk Dealers, Palace Hotel, San Francisco.

November

30–Nov. 1—Associated Grocery Manufacturers of America, Waldorf-Astoria Hotel, New York.
30–Nov. 3—American Bottlers of Carbonated Beverages, Palace of Fine Arts, San Francisco.
6–10—American Honey Institute, Sacramento, Calif.
15–17—National Cooperative Milk Producers Federation, Hotel Congress, Chicago.
15–18—1939 Dairy Manufactures Conference, University of Illinois, Urbana.

Exporters Get War Warning

American exporters have been urged by the Department of Commerce to have assurance from their consignees in Britain and France that licenses and British exchange permits are on hand before shipments leave the United States. Failure to comply with these war-time measures may result in serious loss, as there is no assurance that the unlicensed shipment can be returned to the United States, or that payment for the goods can be obtained.

Plans for War Purchases Being Made, Just in Case

Organization of a staff for the War Resources Board is proceeding actively. That agency will be the dictator of supplies, labor, power and transportation if the United States becomes involved in any military activity. Like the War Industries Board of 1917-18, it will be the agent of the commander-in-chief and will undoubtedly have large powers granted to it by Congress. A food section in the commodities division is expected.

Two classes of food supply for military purposes are contemplated. Those

IRRADIATES BOTTLE HOODS

Hood-caps supplied to dairies for protecting the pouring lip of the milk bottle are being irradiated by Cowdrey Products Co., Fitchburg, Mass. Twenty-one germicidal lamps continuously irradiate the hoods from the time the paper is unrolled until the finished hoods are put into sealed containers. The treatment is said to reduce the bacteria count on the hoods from a commonly accepted limit of 500 to an average of less than ten.

commodities which are used in the zone of military activity will be handled by units comparable with the AEF "Services of Supply." All food for such purposes will be purchased by the Quartermaster Corps under the direct control of Washington in order to coordinate movement into any military area. Much more food will presumably be needed for the military units in training camps and reserve areas. Food supply for such groups will continue on the customary Quartermaster Corps basis, largely on the assumption of locally authorized purchases or requisition.

It is probably not necessary to rush to Washington with a lot of food problems bearing on these questions of supply and control. There will be much less disturbance of food movement and food manufacture than of other types of industrial activity. Some diversion from normal to specialized military supply is expected, but those who will be requested to make any quick change are being individually notified by the appropriate military officers.

Food Technology Courses

Designed to meet the needs of plant managers, executives, purchasing agents, inspectors and others dealing with foods or related products is an evening course in food technology offered by Temple University, Philadelphia. Temple University also announces an evening course in applied dairy procedure.

CAPITAL VIEWS

THE PRICE PROBLEM—Runaway prices, especially prices of foods, have given great strength to the bureaucratic Washington folks who want complete controls established over industry. It is expected that one of the important items of preparedness legislation which will be pressed when Congress gets through talking about "neutrality" will be a price-control measure. "Profiteering" is certainly going to be eliminated wherever possible. And the food man is likely to achieve, probably quite unwillingly, an A-1 priority in the list of profiteers if something cannot be done to keep food prices relatively stable.

The seriousness with which the President views this matter is evident from the lifting of the sugar import quotas by executive order on Sept. 11. The only kind of price increases that the administration welcomes are those on agricultural raw materials which have been largely in surplus. Food manufacturers will have to look out that they are not caught between a Washington demand that raw materials prices rise, but that retail prices stay constant.

NEW SUGAR DIFFICULTY—In the course of the hearings on standards of identity for fruit preserves, jellies and butters, it became evident that one of the principal sugar worries of the Food and Drug Administration has to do with sucrose sirups of relatively low purity. There now is evident a disposition on the part of these officials to insist that the sirups used in food manufacture be largely made from refined cane or beet sugar. Certainly the effort of the officials is going to be to restrict other sirups made by methods which do not fully achieve the sugar purity of finished-beet or refined-cane sucrose.

FRUIT AND VEGETABLE GRADES—A complete new set of rules and regulations has been issued by the Department of Agriculture through Agricultural Marketing Service (successor of Bureau of Agricultural Economics) regarding the grades and certification of canned fruits and canned vegetables. Canners were informed about this in the *Federal Register* on Aug. 29. Other types of food manufacturers interested in the way such regulatory grading is handled should study these canned goods standards. The same technic may be applied to other manufactured and processed foods as time goes on.

KILLING FOOD STANDARDS—Very little help is being given by some of the more zealous members of the Food and Drug Administration staffs who have to do with the fixing of standards of identity. Not only is elaborate ritual being insisted upon for legal reasons, but standards when formulated after hearings are being made so complicated as to make label declaration of all the ingredients about as easy as the conformity with standards. Some of these folks are being criticized about Washington very sharply. They are even accused of being so much in favor of complete label declaration of all food ingredients as to be charged with deliberate effort to torpedo the standards program.

Regardless of motive of any individuals, the result is certainly that fixing of standards of identity will go very slowly in coming months. It is not expected that more than a half dozen major standards can be put in force by Jan. 1. As a consequence, many great industry groups will be compelled either to resort to complete label declarations of ingredients or to demand a further delay in this part of the label law by action of the Secretary of Agriculture. Since the Secretary and all of his staff are very anxious to avoid further postponement of the effective date of the law with respect to labels, this matter is likely to become a subject of bitter recrimination during October and November.

TRUCK RESTRICTIONS—The ICC examiner who has been conducting the hearings on proposed regulations for privately owned trucks has reported. He recommends to the Commission a finding that public safety requires the establishment of the same regulation for privately owned trucks as for common or contract carriers. Particularly these regulations would prescribe qualifications of drivers, maximum hours of service and standards of equipment. Since the Commission is much in favor of restricting truck activity in order to encourage the return of transport business to the railroads, it is expected that rather drastic rules of this sort will be formulated.

The movement is admittedly a pro-railroad anti-truck effort. The same general attitude accounts for the vigorous effort which will be renewed in the next session of Congress to force ICC control of waterway carriers. Such effort would, of course, raise costs of water transportation and make it easier for rail carriers to recoup their business.

WAR TAXES—The present tax laws will raise stupendous sums of money for Uncle Sam if business booms a bit. For this reason it is not now expected that Congress is likely to think it necessary to establish any new war or preparedness taxes. The only new tax troubles likely for the food man are, therefore, those involved in the new proposals of processing taxes on raw materials. Money so raised would, of course, be intended to aid in further farm relief.

SOUTH AMERICAN OPPORTUNITY—New markets for American manufactures are immediately opened throughout Latin America by the interruption of supply of goods from Germany and other European powers. To some extent this means new food markets. How serious the need for American supplies can be is evident from the complete revocation of many drastic restrictions made recently by the Argentine, which now welcomes American imports where formerly they were practically excluded. That country may be a poor one for American food manufacturers, but others which do not have food processing plants within their borders are surely going to be larger buyers in the United States.

Discuss Seedless Fruit, New Industry, Vitamins

Canning of Atlantic crab meat will develop into a new American industry, according to Prof. Carl R. Fellers, Massachusetts State College, who presented a paper before the Division of Agricultural and Food Chemistry at a meeting of American Chemical Society in Boston last month. Professor Fellers explained that the problem of successfully canning the crab meat had been solved by (1) proper selection of crabs, (2) new methods of handling to remove the meat, (3) the use of a protective dipping brine and (4) the sterilization process which is sufficient to kill all micro-organisms. The real heart of the new process lies in the protective brine dip. Added to the salt brine are small amounts of aluminum salts and lactic or other edible acid.

Some day seedless fruits may be available. This was the conclusion drawn by Dr. Felix G. Gustafson, of the University of Michigan, who spoke at the American Chemical Society meeting. Several experiment stations and some commercial greenhouses are conducting experiments to perfect less expensive methods of producing parthenocarpic (seedless) fruits, Dr. Gustafson reported. Present methods involve treating the plant with chemicals to induce development of the fruit without pollenation.

Investigations have revealed that vitamins are present in canned foods to a great extent, according to a paper by Dr. Gulbrand Lunde of the Norwegian Canning Industry Research Laboratory. Vitamin D and the heat-stable B factor are not at all affected by the canning process. Vitamin A is not affected when air is excluded from the can during processing. Vitamins B_1 and C are destroyed to the extent of about 20 per cent of the original contents.

Coffee Industry Meets

Coffee is by far the most popular beverage in the home, J. W. Millard, Arthur Kudner, Inc., reported at the annual meeting of Associated Coffee Industries of America, held in New York at the close of August. Coffee's nearest competitor is milk, according to Mr. Millard, and tea is next in line. Coffee is served regularly every day in 92 per cent of all the homes, and its consumption is evenly spread over all income classes.

Schedule of Action on Food Standards

	Docket number and commodity	Type of standard or regulations	Presiding officer	A First announced in Fed. Register	B Initial hearing date	C Preliminary briefs due not later than	D Examiner's findings published in Fed. Register	E Secretary's order published in Fed. Register	F Effective date of order
1-A	Tomato puree	Identity ..	J. M. Fox...	Dec. 15, '38	Jan. 16, '39	Feb. 27, '39	April 4, '39	July 18, '39	Jan. 1, '40
1-B	Tomato paste			Dec. 15, '38	Jan. 16, '39	Feb. 27, '39	April 4, '39	July 18, '39	Jan. 1, '40
1-C	Tomato catsup			Dec. 15, '38	Jan. 16, '39	Feb. 27, '39	April 4, '39	July 29, '39	Jan. 1, '40
1-D	Tomato juice.....			Dec. 15, '38	Jan. 16, '39	Feb. 27, '39	April 11, '39	July 29, '39	Jan. 1, '40
2	Canned tomatoes ..	Identity, quality, fill, substandard labeling.	J. M. Fox...	Dec. 15, '38	Jan. 15, '39	Mar. 10, '39	April 12, '39	July 18, '39	Jan. 1, '40
3-A	Eggs	Identity ..	J. M. Fox...	Dec. 15, '38	Jan. 23, '39	Mar. 13, '39	May 10, '39	July 20, '39	Oct. 17, '39[6]
3-B	Liquid whole eggs...			Dec. 15, '38	Jan. 23, '39	Mar. 13, '39	May 10, '39	July 20, '39	Jan. 1, '40
3-C	Liquid mixed eggs...			Dec. 15, '38	Jan. 23, '39	Mar. 13, '39	May 10, '39	July 20 '39	Jan. 1, '40
3-D	Frozen whole eggs...			Dec. 15, '38	Jan. 23, '39	Mar. 13, '39	May 10, '39	July 20 '39	Jan. 1, '40
3-E	Dried whole eggs....			Dec. 15, '38	Jan. 23, '39	Mar. 13, '39	May 10, '39	July 20, '39	Jan. 1, '40
3-F	Egg yolk.....			Dec. 15, '38	Jan. 23, '39	Mar. 13, '39	May 10, '39	July 20, '39	Jan. 1, '40
3-G	Frozen egg yolk.....			Dec. 15, '38	Jan. 23, '39	Mar. 13, '39	May 10, '39	July 20, '39	Jan. 1, '40
3-H	Dried egg yolk.....			Dec. 15, '38	Jan. 23, '39	Mar. 13, '39	May 10, '39	July 20, '39	Jan. 1, '40
4	Coal-tar colors.....	Listing and certification	F. S. Hassell	Jan. 7, '39	Feb. 6, '39	Mar. 3, '39	April 8, '39	May 9, '39[1,5]	May 9, '39[2]
5-I	Canned peaches.....	Identity, quality, fill	J. M. Fox...	Mar. 7, '39	April 10, '39	June 26, '39[3]	Sept. 7, '39	.....	.....
5-II	Canned apricots ...			Mar. 7, '39	April 10, '39	June 26, '39[3]	.....	.....	.....
5-III	Canned pears.....			Mar. 7, '39	April 10, '39	June 26, '39[3]	.....	.....	.....
5-IV	Canned cherries.....			Mar. 7, '39	April 10, '39	June 26, '39[3]	.....	.....	.....
6	Canned peas	Identity, quality, fill	J. M. Fox...	Mar. 7, '39	April 17, '39	June 29, '39[3]	.....	.....	.....
7-A	Cream.....	Identity ..	F. S. Hassell	Mar. 28, '39	May 1, '39	July 27, '39[3]	.....	.....	.....
7-B	Whipping cream.....			Mar. 28, '39	May 1, '39	July 27, '39[3]	.....	.....	.....
7-C	Evaporated milk....			Mar. 28, '39	May 1, '39	July 27, '39[3]	.....	.....	.....
7-D	Sweetened condensed milk.....			Mar 28, '39	May 1, '39	July 27, '39[3]	.....	.....	.....
7-E	Dried skim milk ..			Mar. 28, '39	May 1, '39	July 27, '39[3]	.....	.....	.....
8	Canned vegetables	Identity ..	F. S. Hassell	Mar. 24, '39	April 24, '39	June 19, '39[3]	Aug. 15 '39	.....	.....
9	Coal-tar colors[4].....	Amendment of regulations promulgated by order of May 9 (Docket 4)	F. S. Hassell	June 3, '39	July 5, '39	July 20, '39	Aug. 16, '39	.....	.....
10-A	Fruit jams.....	Identity	M. F. Markel.	Aug. 11, '39	Sept. 11, '39	.....	.....	.....	.....
10-B	Fruit jellies	Identity	M. F. Markel.	Aug. 11, '39	Sept. 11, '39	.....	.....	.....	.....
10-C	Fruit butters.....	Identity	M. F. Markel.	Aug. 11, '39	Sept. 11, '39	.....	.....	.....	.....
11-A	Cheddar cheese....	Identity.....	W. G. Green, Jr.	Aug. 22, '39	Sept. 25, '39	.....	.....	.....	.....
11-B	Washed curd cheese.			Aug. 22, '39	Sept. 25, '39	.....	.....	.....	.....
11-C	Colby cheese.....			Aug. 22, '39	Sept. 25, '39	.....	.....	.....	.....
12	Cream cheese.....	Identity.....	W. G. Green, Jr.	Aug. 22, '39	Oct. 2, '39	.....	.....	.....	.....

[1] Typographical errors corrected in Fed. Register, June 3, '39.
[2] Time extended from earlier date previously announced.
[3] No definition or standard ordered for eggs: definition included for each egg product.
[4] Standard of identity only; standard of quality and standard of fill of container published in *Federal Register* on Sept. 15, 1939.
[5] Emergency declared to exist, order effective on publication.
[6] Amending order of Docket 4.
[7] See also Docket 9.

Procedure for Fixing Standards for Foods

Standards of identity, standards of quality, standards of fill of container and label specifications for substandard commodities are fixed by the Department of Agriculture according to the following routine (letters at beginning of paragraphs correspond to letters at top of columns in accompanying table):

A. Announcement is published in the *Federal Register* giving tentative form of standards, date and place of initial hearing, presiding officer (examiner) and scope of proceedings.

B. The hearing is held and the examiner prepares and files transcript of record.

C. Announcement is published in the *Federal Register* of the latest date at which briefs in argument or proposed findings of fact, or both, may be submitted by any interested party.

D. Examiner formulates, on the basis of the hearing and briefs, findings of fact and suggested standards. These are published in the *Federal Register*, and a copy is sent to each of those for whom appearance was entered at the hearing. Within ten days after receipt of this copy any person who wishes may file objection to the suggested findings of fact or standards with the Hearings Clerk of the Department of Agriculture.

E. Secretary of Agriculture reviews case and publishes his order in the *Federal Register*, establishing the standards.

F. Standards take effect at some named date thereafter, not sooner than 90 days following the publication except in case of emergency.

Further protest or appeal from the order of the Secretary may take the form of (*a*) comments to him, on the basis of which the case may be ordered reopened, or (*b*) petition to the proper Circuit Court of Appeals of the United States within 90 days of issue of Secretary's order.

Construction News

	Pending (thousands)	Awarded September (thousands)	Total Awarded 1939 (thousands)
Bakery	$70	$1,750	$2,889
Beverages	330	50	4,508
Canning and Preserving	.....	.....	200
Confectionery	.....	.....	75
Grain Mill Products	320	60	3,135
Ice Manufactured	50	40	335
Meats and Meat Products	160	270	727
Milk Products	2,240	80	1,196
Miscellaneous	430	40	2,459
	$3,600	$2,290	$15,524

For the first time in its history, the association elected as its president a man from the West Coast. It chose George C. Thierbach, San Francisco, who is a past-president of Pacific Coast Coffee Association. The next convention of the association is to be at White Sulphur Springs, W. Va.

New Grading Regulations

New regulations governing the grading and certification of canned fruits and vegetables became effective Aug. 25 and were published in the Aug. 29 issue of the *Federal Register*. This grading service is available to any person having a financial interest in the products involved. The fees for the service are reasonable.

Franks Free of Trichinae

There is no danger of contracting trichinosis from eating frankfurters produced by federally inspected meat-packing establishments, according to a report by the United States Department of Agriculture. A study of 1,118 half-pound samples of frankfurters from 175 federally inspected packing houses in 30 cities and in 25 states showed that 1,107 of the samples, or about 99 per cent, contained no trichinae, while the remaining 11 samples contained a few of the microscopic parasites all of which were dead and therefore harmless.

Commodity Price Chaos Follows European War

When war broke out on Sept. 1, American food sellers and consumers telescoped the memories of the years 1914–1917. Apparently on the assumption that world food trade had already reached a position parallel to that of late 1916 or early 1917, raw material prices started to soar and retail food prices, boosted by consumer hoarding, set out for Alpine peaks.

However, sober second thought and some activity by government slowed down the climb. By mid-September, most food raw material prices were fairly well stabilized at levels 12 to 25 per cent above those of mid-August. Many processed foods, however, were still sensitive to the war boom, with some lines withdrawn from the market.

Comparisons of prices of important food commodities for the beginning and end of the four weeks period from Aug. 18 to Sept. 15 show the following changes: wheat, No. 2, dark winter, 61¼c. to 85c.; flour, spring patents, $4.75 to $5.85; corn, No. 3, yellow, 44½c. to 60½c.; beef, steers, 14c. to 16½c.; lamb, 16c. to 17c.; pork, loins, 14½c. to 22c.; lard, $5.95 to $8.35; eggs, 16c. to 19½c.; butter, 24¼c. to 28½c.; cheese, 14¾c. to 16¼c; sugar, raw, duty paid, $2.83 to $3.70; cocoa, $4.33 to $6.10; coffee, Santos, No. 4, 7½c. to 7¾c.; cottonseed oil, 4¼c. to 6⅛c.; canned tomatoes, No. 2, Maryland, 56½c. to 65c.; canned salmon, No. 1, red, $2.05 to $2.25. In contrast, canned peaches fell from $1.35 to $1.22½.

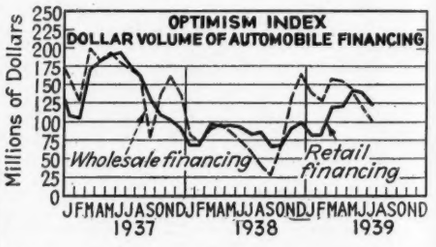
So far as these increases occurred among the food raw materials, low prices existing in August fully justified the raise. Even now, the level of prices paid to farmers is not excessive, in view of the price level of manufactured goods bought by farmers. Should no great further price increases above the level of Sept. 15 occur among food raw materials, a more stable general price structure should result.

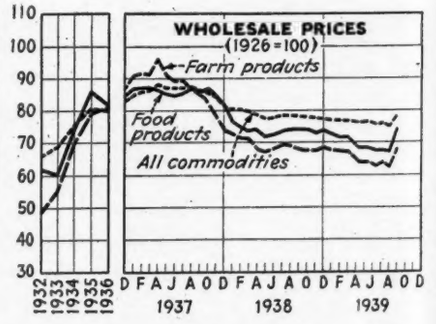
In the matter of processed food prices, the situation is more uncertain. Some processed foods, among them lard, bacon, dried fruits and canned fish, are likely to be eagerly sought by warring nations. Until it becomes

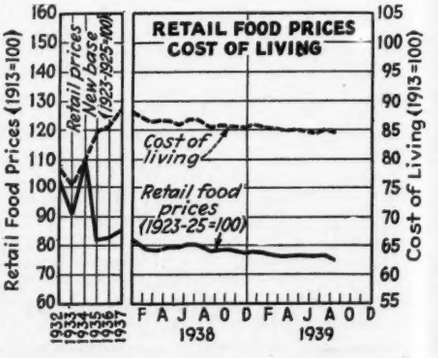
United States Foreign Trade in Foods

	EXPORTS (Monthly Averages)		IMPORTS (Monthly Averages)		
	All Food Stuffs (In Dollars) 000,000 omitted)	Manufactured Foods and Beverages (In Dollars) 000,000 omitted)	Wholesale Prices Foods (Per Cent) 1926 = 100	Total Foodstuffs (In Dollars 000,000 omitted)	Manufactured Foods and Beverages (In Dollars 000,000 omitted)
1913	41.2	27.0	64.2	34.8	16.5
1914	48.6	25.7	64.7	40.8	21.3
1915	84.3	45.8	65.4	42.9	22.7
1916	89.1	54.0	75.7	49.8	28.2
1917	109.6	67.2	104.5	61.3	29.2
1918	162.7	117.1	119.0	61.9	33.1
1919	220.0	163.5	129.5	91.7	46.3
1920	169.5	93.0	137.4	151.2	103.1
1921	113.1	57.0	90.6	55.6	30.6
1922	87.2	48.9	87.6	59.6	32.2
1923	70.0	48.6	92.7	74.3	44.1
1924	80.5	47.7	91.0	78.8	43.4
1925	74.3	47.8	100.2	77.2	36.0
1926	69.8	41.9	100.0	79.7	34.8
1927	73.7	36.6	96.7	79.5	37.5
1928	63.3	38.8	101.0	79.6	33.8
1929	62.8	40.3	99.9	80.1	35.3
1930	45.0	30.2	90.5	57.7	24.4
1931	31.1	20.5	74.6	43.9	18.5
1932	20.1	12.6	61.0	33.8	14.4
1933	16.9	12.8	60.5	34.7	17.1
1934	18.8	13.9	70.5	43.0	21.9
1935	17.9	13.1	83.7	53.3	26.5
1936	16.8	11.9	82.1	61.1	32.1
1937	23.2	14.7	85.5	71.0	36.6
1938	36.1	15.3	72.8	47.6	25.9
1939					
January	31.0	14.6	71.5	43.4	16.6
February	26.5	15.1	71.5	41.5	18.6
March	27.9	15.6	70.2	54.4	26.2
April	23.6	13.8	68.6	49.1	25.0
May	26.9	16.1	68.2	51.9	26.0
June	19.5	13.4	67.6	50.2	27.7

The statistics in this table record what happened to U. S. food exports, imports and wholesale food prices during the period 1913 to 1939. These figures show tremendous increases for the period of the World War (1915-1919), but it should be kept in mind that the situation at present is not a parallel, for Russia has changed sides and the British Empire has greatly increased its home production, as has France, among other things.







evident what quantities of processed foods will be sold for export, price stability is not likely in the manufactured food field, except in such lines as baked goods, confectionery, dairy products and beverages, where the export market is not important.

Crops Are Big

In spite of all the reports of unfavorable weather, 1939 crop yields are indicated to be at high levels, according to the September report of the U. S. Department of Agriculture. Corn production is estimated at 2,523,000,000 bu., compared to a 1929-1937 average of 2,310,000,000 bu. Wheat yield is estimated to be about equal to the 1929-1937 average, while rice, dry edible beans, peanuts, sugar cane, sugar beets, apples, hops, grapes, peaches and pears are estimated to be above that average. The potato crop is expected to be smaller, 364,208,000 bu. compared to 372,258,000 bu.

Among the canning crops, a yield of 1,675,800 tons of tomatoes for manufacture is expected, 15 per cent above the 1929-1937 average. Sweet corn for manufacture is estimated at 8 per cent below the average of 1929-1937, but snap beans for canning are indicated to be 4 per cent above that average. Green lima bean production for canning and freezing is put at 30,200 tons, a record that compares to 28,740 tons last year and to a 1929-1937 average of 15,090 tons.

Sugar Supplies Large

Even though sugar prices skyrocketed in early September and then steadied to a level about 25 per cent over the August figure, the supply situation does not foreshadow anything remotely resembling a shortage. World sugar production in 1914 was about 18,500,000 tons, in contrast to an output of 29,642,000 tons during the recent crop year. In addition, this year there was a carryover of more than 10,000,000 tons from preceding years. This supply would indicate that there are ample stocks of sugar available, so that no shortage need be expected during the next year or two, even though output is decreased and demand increased in the warring countries.

Data for the Charts

In preparing the curves shown on this and the preceding page of FOOD INDUSTRIES, data were obtained from the following sources: Prices received by farmers, U. S. Department of Agriculture; employment, payrolls, wholesale and retail prices, U. S. Department of Labor; cost of living, National Industrial Conference Board; commodity price index, *N. Y. Journal of Commerce;* business acivity index, *Business Week;* data on automobile financing are from U. S. Department of Commerce.

INDICATORS

BUTTER, creamery, produced in the United States in July, 1939, totaled 179,275,000 lb., compared to 184,275,000 lb. in July, 1938, and a 1930–1937 average of 169,585,000 lb. for July.

CHEESE PRODUCTION in July, 1939, was 58,400,000 lb., 10 per cent below July, 1938, but 21 per cent over the 1930–1937 average for the month.

CONDENSED and evaporated milk produced in July, 1938, totaled 243,462,000 lb.

OLEOMARGARINE SALES in July, 1939, as indicated by sales of internal revenue stamps, totaled 19,916,586 lb., compared to 26,812,970 lb. for the same month of 1938.

PEAS CANNED in 1939 totaled 16,327,772 cases, according to National Canners Association. This compared to 25,430,315 cases packed last year.

FROZEN FRUITS in storage on Sept. 1, 1939, totaled 139,975,000 lb., compared to 151,403,000 lb. on Sept. 1, 1938, and a 1934–38 average for the date of 104,770,000 lb.

FROZEN VEGETABLES in storage, Sept. 1, 1939, amounted to 69,389,000 lb., compared to 61,352,000 lb. a year before.

BUTTER, creamery, in storage on Sept. 1, 1939, was 173,093,000 lb. A year before the total was 201,252,000 lb., and the 1934–38 average for the date was 145,113,000 lb.

CHEESE, all kinds, in storage on Sept. 1, 1939, totaled 124,885,000 lb., compared to 150,248,000 lb. on Sept. 1, 1938, and a 1934–38 average of 121,757,000 lb. for the date.

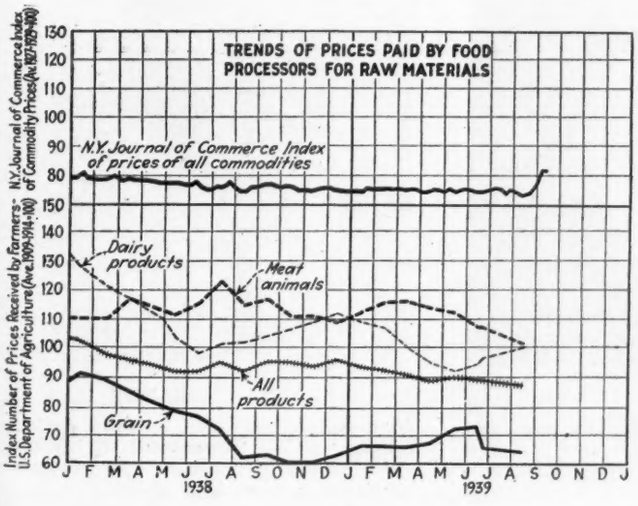
EGGS, case equivalent, in storage on Sept. 1, 1939, were 10,479,000 cases. The figure one year before was 9,514,000 cases and the 1934–38 average for the date was 10,864,000 cases.

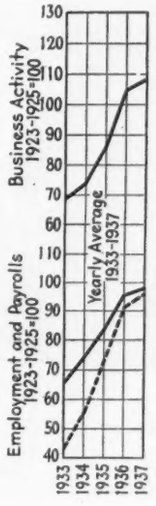
POULTRY, all kinds, in frozen storage on Sept. 1, 1939, totaled 63,789,000 lb., compared to 54,941,000 lb. on Sept. 1, 1938, and a Sept. 1 average for 1934–38 of 53,024,000 lb.

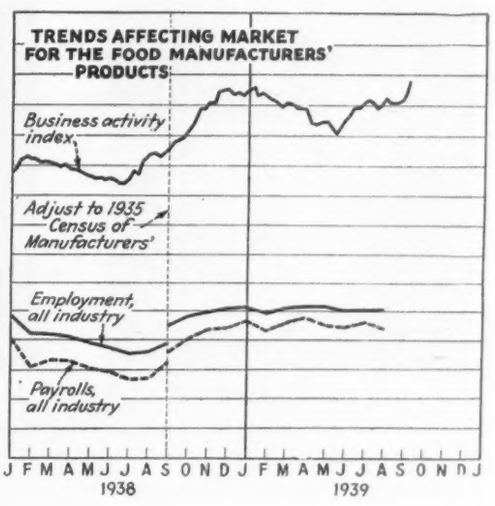
MEAT, all kinds, in cure and frozen storage on Sept. 1, 1939, was 463,633,000 lb. On Sept. 1, 1938, the figure was 431,272,000 lb., and the 1934–38 average for Sept. 1, was 518,843,000 lb.

LARD, in storage Sept. 1 this year totaled 112,145,000 lb., compared to 116,620,000 lb. a year before, and a 1934–38 average for Sept. 1 of 113,193,000 lb.

WEEKLY FOOD INDEX of Dun & Bradstreet, Inc., stood at $2.45 on Sept. 12. The figure compares to $2.44 just one year before and to $2.16 on Aug. 29, 1939.


TRENDS OF PRICES PAID BY FOOD PROCESSORS FOR RAW MATERIALS
N.Y. Journal of Commerce Index of prices of all commodities
Dairy products
Meat animals
All products
Grain
Index Number of Prices Received by Farmers U.S. Department of Agriculture (Ave. 1909-1914=100)
N.Y. Journal of Commerce Index of Commodity Prices (Ave. 1927-29=100)
J F M A M J J A S O N D J F M A M J J A S O N D J
1938
1939




TRENDS AFFECTING MARKET FOR THE FOOD MANUFACTURERS' PRODUCTS
Business activity index
Adjust to 1935 Census of Manufacturers'
Employment, all industry
Payrolls, all industry
J F M A M J J A S O N D J F M A M J J A S O N D J
1938
1939

Men, Jobs & Companies

INDUSTRY

Arlington Heights Fruit Co., Riverside, Calif., will build an $80,000 fruit packing plant measuring 60x208 ft.

Borden Co., New York, has purchased the ice cream business of United Farmers Cooperative Creamery Association, Inc., in the greater Boston area and in Vermont. Paul Beck is manager of the new unit acquired by Borden.

Carnation Milk Co., Inc., is erecting a $35,000 milk receiving and cooling station at Riner, Va.

Fairfield Western Maryland Dairy, Baltimore, will spend about $1,600,000 to construct and equip a new plant.

Frank Tea & Spice Co., Cincinnati, has purchased the Widlar spice division of Standard Brands, Inc., Cleveland. The equipment will be moved from Cleveland to Cincinnati.

General Mills, Inc., Minneapolis, has established a new market analysis department. This department will study problems relating to buying habits, distribution peculiarities, merchandising and advertsing coverage. It is under the management of A. W. Wilbor, formerly in charge of advertising research at General Mills.

GEORGE A. EASTWOOD

Only recently named executive vice-president of Armour & Co., Chicago, he now succeeds Robert H. Cabell as president of the company. Mr. Eastwood started with Armour as an office boy in Albany, N. Y., in 1897. By 1929 he had risen to vice-president in charge of the byproducts auxiliaries. Mr. Cabell will be 70 years old in December, and he had been planning on retiring when he was made president four years ago.

Lehigh Valley Cooperative Dairy Association, Allentown, Pa., will build a $100,000 addition to its plant.

Marto Bakery, Inc., recently organized in Fort Wayne, Ind., to do a direct delivery business, will conduct baking operations in full view of the public through a glass front in its building.

Mayflower Ice Cream Corp., Long Island City, N. Y., will spend $45,000 for new equipment and plant improvements. This is part of an expansion program to handle increasing business.

Oscar Mayer & Co., Madison, Wis., will spend about $115,000 to erect a five-story addition to its meat house and an addition to its sheep slaughtering building.

Pepsi-Cola Co., Long Island City, N. Y., reports that within 30 days more than 8,000 new chain store outlets were obtained for its beverage.

Scala Packing Co. plans to make additions and improvements to its meat packing plant at Utica, N. Y., at a cost of more than $75,000.

Safeway Stores, Ltd., Oakland, Calif., has purchased the business of Empress Manufacturing Co., Vancouver, B. C., the largest jam packing firm in western Canada.

Paul Schulze Biscuit Co., Chicago, is building a new plant at a total cost of

GLENN D. HOSKINS

Formerly a vice-president of Foulds Milling Co., Libertyville, Ill., he has opened an office in Chicago to carry on a specialized service to macaroni manufacturers.

CHARLES P. McCORMICK

President of McCormick & Co., Inc., Baltimore, he has been appointed a class C director of the Federal Reserve Bank of Richmond.

JAMES F. BRANDT

He is the new controller for Swift & Co., Chicago, having succeeded J. G. Smithwick, retired on pension. Mr. Brandt continues as personnel director.

$650,000. The land for the plant cost $200,000, the building will cost $250,000, and equipment costing $200,000 will be installed.

Treesweet Products Co., Santa Ana, Calif., has developed a new process of canning orange juice. The process embodies new extracting, filling and pasteurizing equipment, and an important factor in it is keeping the air away from the juice from the time it is extracted until the can is sealed.

Van Camp Milk Co. has moved its headquarters from Indianapolis to Fort Wayne, Ind. The latter city is said to be a more central location in relation to the company's distributors.

Washington Frosted Foods, Inc., experienced damage estimated at $100,000 when the fire destroyed its refrigeration and storage plant at Kent, Wash., on Aug. 20.

Wilson & Co., Chicago, will construct this fall a new warehouse for the display of meats and meat products in Springfield, Mass.

PERSONNEL

Arthur Ball, treasurer of Ball Bros., Inc., Muncie, Ind., has become president and general manager of Ajax Brewing Corp., Indianapolis. He succeeds J. L. Reuss, who has gone with Centlivre Brewing Co., Fort Wayne, Ind.

Miss Mary I. Barber, home economics director of Kellogg Co., Battle Creek, Mich., has been named president-elect of American Dietetic Association.

Tom F. Barry, newspaper man, public relations counsel and writer, is now director of publicity for Pepsi-Cola Co., Long Island City, N. Y. A company house organ, devoted to the affairs of the company, its franchise bottlers, distributors and employees will be published under Mr. Barry's direction.

Earl Brooks has been named manager of Walter Bros. Brewing Co.'s new branch plant at Antigo, Wis.

Benjamin C. Brown, president of Brown's Velvet Ice Cream Co., New Orleans, has been named a member of the board of commissioners of the port of New Orleans.

John E. Cain, president of John E. Cain Co., Cambridge, Mass., has been re-elected president of National Food Distributors Association.

Clarence Christoffel recently was transferred as manager of the Indianapolis plant of Omar Baking Co. to a similar position at Columbus, Ohio.

Earle J. Freeman has been made vice-president in charge of domestic sales of Kellogg Co., Battle Crek, Mich. Mr. Freeman has been with the company for twenty-five years.

Lester W. Jones, purchasing agent for McCormick & Co., Inc., Baltimore, is a newly elected member of the board of directors.

B. B. Loveland is the new manager of the Memphis branch of the Cudahy Packing Co. He succeeds the late E. M. Doyle.

Norman H. Mayo has been made managing director of the Simmons & Hammond Division (Maine) of General Ice Cream Corp., Schenectady, N. Y., succeeding the late Paul S. Harmon.

R. H. McFadden is now president of Sanitary Milk Co., Canton, Ohio. He succeeds E. J. Helbig, resigned.

Harold W. McMillen recently was elected president of the Central Sugar Co., Inc., Decatur, Ill., and Fort Wayne, Ind. He has been vice-president and general manager for two years. Roy Hall is retiring as president of the company, but retains a directorship.

Dr. Lee T. Smith, chemist in the re-

★ Cercon is an edible, tasteless wax suitable for coating food products requiring protection from the air.

It is supplied in six colors—Snowdrift, Lemon, Orange, Tangerine, Apricot, and Olive. It has an ASTM penetration of 50 with the 50 gram weight attached.

We will be very glad to send test samples to any interested company.

THE CONEWANGO REFINING CO.
WARREN, PENNSYLVANIA

search laboratories of the Bureau of Dairy Industry, Washington, D. C., has been elected to head the carbohydrate and derived products division of the Eastern Regional Research Laboratory of the Bureau of Agricultural Chemistry & Engineering.

DEATHS

J. M. Adams, 85, founder and former president of Arkadelphia (Ark.) Milling Co., at Longview, Tex.

Max T. Brown, 41, owner of Blue Cross Milling Co., Little Rock, Ark., recently.

Dr. Ernest C. Dickson, 58, professor of public health and preventive medicine at Stanford University Medical School, since 1926, Aug. 24. Dr. Dickson became known in the food industries through pioneer work on botulism.

C. Arthur Feickert, 70, retired head of Feikert Bakery, Belleville, Ill., Sept. 3. He was the first president of Illinois Bakers Association.

W. W. Frazier, Jr., 75, former vice-president and sales manager of Franklin Sugar Refining Co., Aug. 24., at Chestnut Hill, Pa. Mr. Frazier retired from the company in 1933.

Frank O'Connor, 54, founder of the Laura Secord Candy Shops, Inc., in Canada, and Fanny Farmer Candy Shops, Inc., in the United States, Aug. 21, at Toronto.

H. D. Munger, Sr., 89, director of Holley (N. Y.) Canning Co., Aug. 25. He was the father of L. E. Munger, president of the company.

Dr. Paul D. Isham, 32, research chemist in the Washington laboratory of the National Canners Association, Aug. 28, at Portland, Me.

Fred L. Shoenberger, for several years secretary of the Ohio Dairy Poducts Association, Sept. 2, at Columbus.

William Wieland, 52, one of six brothers who operated Wieland Dairy Co., Chicago, for many years, on Aug. 21. He was the son of Jacob Wieland, founder of the dairy company.

ASSOCIATED INDUSTRIES

Acme Steel Co. has appointed Waldo F. Tucker manager at Los Angeles.

Chain Belt Co., Milwaukee, has acquired the business and all of the net assets of Baldwin-Duckworth Chain Corp., Springfield, Mass.

Federal Motor Truck Co., Detroit, has named Joseph D. Burke vice-president in charge of sales.

Food Research Laboratories, Inc., New York, has appointed Dr. Bernard L. Oser as vice-president.

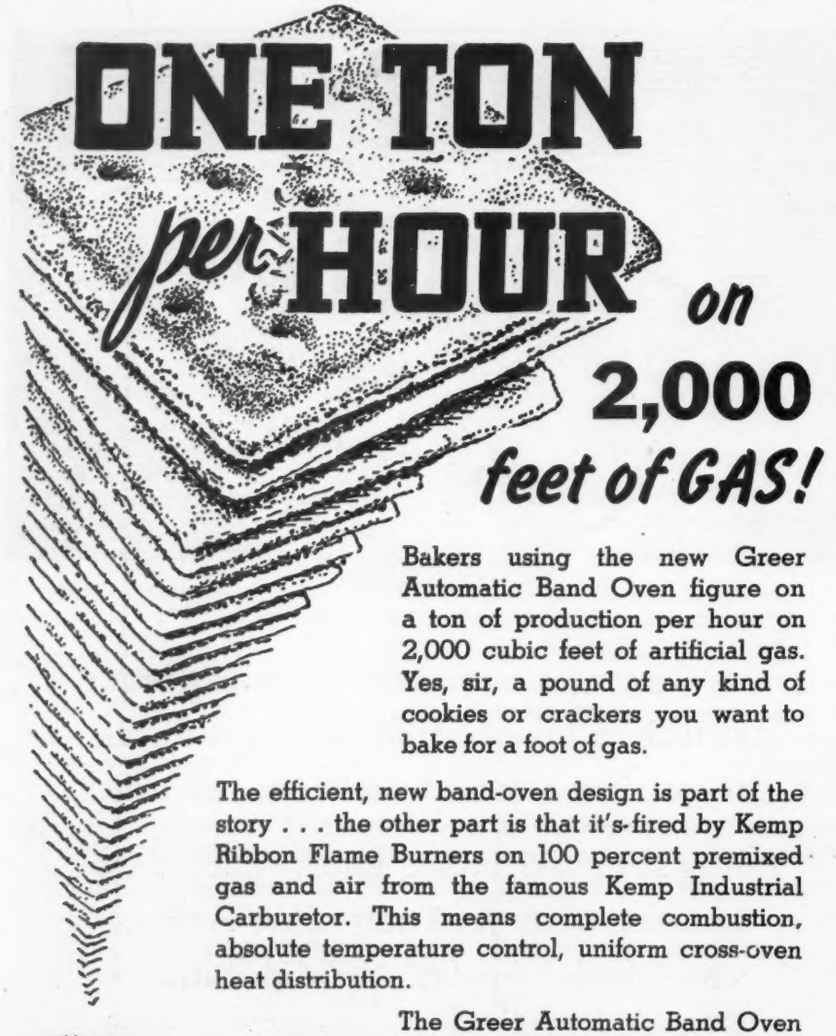
Frick Co., Waynesboro, Pa., has appointed Cyril Leech manager of its branch office at Philadelphia.

Fruehauf Trailer Co. has opened a factory branch in Houston, Tex., under the direction of A. Jack Evans. A complete sales and service organization operates under the jurisdiction of the new branch. Fruehauf has appointed A. E. Hickey regional vice-president in charge of the eastern district and C. D. Carley regional manager for the southeastern section.

General Plastics, Inc., North Tonawanda, N. Y., has consolidated into a new company to be known as Durez Plastics & Chemicals, Inc.

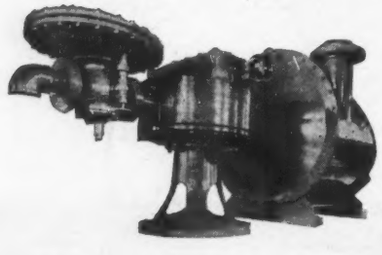
Karl Kiefer Machine Co., Cincinnati, has appointed C. M. Bunn representative in the Chicago territory.

National Adhesives Corp., New York, has changed its name to National Starch Products, Inc.



Bakers using the new Greer Automatic Band Oven figure on a ton of production per hour on 2,000 cubic feet of artificial gas. Yes, sir, a pound of any kind of cookies or crackers you want to bake for a foot of gas.

The efficient, new band-oven design is part of the story . . . the other part is that it's-fired by Kemp Ribbon Flame Burners on 100 percent premixed gas and air from the famous Kemp Industrial Carburetor. This means complete combustion, absolute temperature control, uniform cross-oven heat distribution.



The Greer Automatic Band Oven is just one more application in which Kemp guarantees to save you money . . . or NO SALE! Whatever your heat-treating problem, it will pay you to write . . . **The C. M. Kemp Manufacturing Co. at 405 E. Oliver St., Baltimore, Maryland.**

KEMP of BALTIMORE

Just off the Press

BOOKLETS • LITERATURE • BULLETINS

Food Plant Equipment

AIR CONDITIONING—"Air Conditioning Nonregenerative Performance", by C. R. Downs and J. W. Spiselman, Weiss and Downs, Inc., New York, N. Y., has been issued in reprint form from "Industrial and Engineering Chemistry".

AIR CONDITIONING—Carrier Corp., Syracuse, N. Y., has issued a 12-page illustrated 1939–1940 condensed catalog of air conditioning, refrigeration and heating equipment.

AUTOCLAVES — BLAW-KNOX Co., Pittsburgh, Pa., has published Catalog No. 1685, entitled "Process Autoclaves," describing the manufacture of pressure equipment.

CENTRIFUGALS—Bulletin No. 1225, "Super-Centrifuges", deals with certain centrifugals claimed to develop the highest centrifugal force in commercial use; and Bulletin No. 1221, with applications and installations of centrifugals, products of The Sharpless Corp., 2336 Westmoreland St., Philadelphia, Pa.

FILTERS—Nine "Dicalite Filteraids" for industrial filtration are illustrated with applications, cost, flow rates and capacity data in a 16-page booklet by The Dicalite Co., 520 Michigan Ave., Chicago, Ill.

GRANULATORS—Burns 8-roll granulators designed for two-grind and three-grind coffee merchandising are featured in a recent bulletin of Jabez Burns & Sons, Inc., 11th Ave. at 43d St., New York, N. Y.

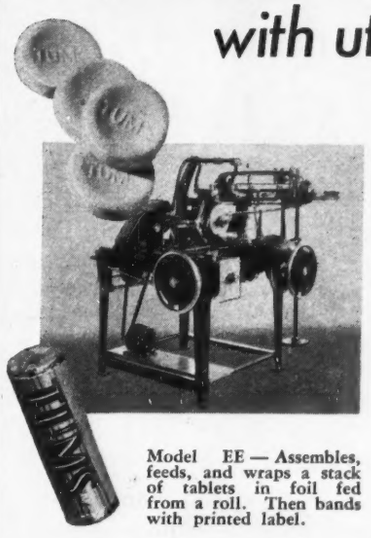
JAR MILLS—Bulletin 250 of The United States Stoneware Co., 60 E. 42d St., New York, N. Y., contains information on "Roller-Type" jar mills for grinding and pulverizing.

OVENS — American Machine & Foundry Co., New Haven, Conn., announces their AMF multi-cycle oven

A COMPLETE WRAPPING JOB

with utmost economy and

SELLING VALUE



Model EE — Assembles, feeds, and wraps a stack of tablets in foil fed from a roll. Then bands with printed label.

Tums (Lewis-Howe Company) is a good example of the thoroughness with which our machines meet a manufacturer's wrapping requirements—both for sales value in the package and utmost economy of production.

The loose tablets pour into our Model EE machines and are stacked and wrapped in protective foil with attractive colored bands . . . Then two different sizes of cartons, containing the individual rolls, get neat "Cellophane" wraps on our FA machines . . . Finally, these cartons are *bundled* on our Model F-9 Bundling Machine, which makes large savings over the cost of using cardboard containers.

In plant after plant, you will find our machines doing equally complete and coordinated jobs of wrapping.

Put your packaging problems up to us
Consult our nearest office

Model FA — Wraps cartons of Tums in transparent cellulose fed from a roll. Easily adjustable for an extremely wide range of sizes.

Model F-9—Bundles the cartons in heavy paper, eliminating expense of cardboard containers. Registers printed panels accurately.

PACKAGE MACHINERY COMPANY, Springfield, Massachusetts

NEW YORK CHICAGO CLEVELAND LOS ANGELES TORONTO

Peterborough, England: Baker Perkins Ltd. Mexico, D. F., Apartado 2303
Melbourne, Australia: Baker Perkins Pty., Ltd. Buenos Aires, Argentina: David H. Orton, Maipu 231

PACKAGE MACHINERY COMPANY

Over a Quarter Billion Packages per day are wrapped on our Machines

for big-oven baking performance in small oven space, in a recent leaflet.

SIFTERS—Leaflet No. 2354 of Allis-Chalmers Mfg. Co., Milwaukee, Wis., indicates some of the ways in which heavy duty gyratory sifters may be used by the process industries including milling, baking and confectionery making.

UTENSILS—Heavy and semi-heavy duty utensils and forms made of "Colalloy" are shown in Bulletin Form No. 2639 by Colonial Alloys Co., Colonial Philadelphia Bldg., Philadelphia, Pa.

Plant Accessories and Supplies

ACCELATOR—The accelator for water softening, stabilization or clarification is the subject of Bulletin No. 103804 of International Filter Co., Chicago, Ill.

COMPRESSORS—Bulletin 3426-1 of Ingersoll Rand Co., Phillipsburg, N. J., illustrates and describes refinements and developments incorporated in the "Four Corner" direct-connected, synchronous - motor - driven - compressors, built in sizes from 700 to 3,000 hp.

COUPLING VALVES — Semi-steel valves for use with flexible couplings are described and illustrated in a 12-page catalog by Merco Nordstrom Valve Co., Pittsburgh, Pa.

ENAMEL—"From A Cleveland Laboratory", published by The Sherwin-Williams Co., Cleveland, Ohio, describes a new product, "Kem Lustral Enamel", a finish for wood or metal surfaces subject to exterior or interior exposure.

INSULATION—Wood Conversion Co., 360 N. Michigan Ave., Chicago, Ill., has issued a recent folder on "Balsam-Wool" designed for insulating commercial display cases, coolers, cabinets and refrigerators.

CHAINS—Moline Malleable Iron Co., St. Charles, Ill., has issued a catalog giving listings and prices of malleable chains and chain attachments, sprocket wheels, elevator buckets, and flight conveyors.

MAGNETS—Bulletin No. 25-A on suspended magnets, introducing the new hand magnet for holding small castings for surface grinding operations, has been issued by Stearns Magnetic Mfg. Co., Milwaukee, Wis.

MEASURING APPARATUS—"Apparatus for Electrolytic Conductivity Measurements in Laboratory and Plant", 40-page illustrated Catalog EN-95 replacing Catalog No. 48, describes and lists apparatus manufactured by Leeds & Northrup Co., Philadelphia, Pa., for use in research, industrial plants, general laboratories and educational laboratories for making electrolytic conductivity measurements.

STAINLESS TUBING—The Carpenter Steel Co., Welded Alloy Tube Division, Kenilworth, N. J., has published a folder on welded stainless tubing showing available analyses, specifications, diameter and gage, and shapes and finishes.

STEAM TURBINES—Bulletin No. 2198 of Westinghouse Electric & Manufacturing Co., E. Pittsburgh, Pa., covers seven principal types of turbines in sizes up to 10,000 k.w. with diagrams, illustrations, structural details and application data.

Reduce YOUR MIXING COSTS THE SANITARY "LIGHTNIN" WAY

Replace Paddle Type Agitators

It has been repeatedly proved that LIGHTNIN Patented Double Action Propeller Type Mixing cuts power costs, reduces mixing time and entirely eliminates dead-spots. Complete line includes geared and direct drive portables, top entering and side entering mixers for mixing quantities from one to one million gallons.

Completely sanitary. No pockets for bacteria. Easily cleaned with hot water or steam. Sanitary sealed out-board bearing prevents oil or grease from this source contaminating mix.

"Lightnin" Variable Speed Mixers operate from 100 to 1800 R. P. M.

"Lightnin" Portable Mixers (geared and direct drive) range in size from 1/30 to 10 H. P.

"Lightnin" Top Entering Units (geared and direct drive) for open or closed tank work including pressure and vacuum work.

"Lightnin" Side Entering Units for tanks up to 1,000,000 gals.

"LIGHTNIN" SAVES MONEY MIXING

Carbonated Beverages
Tomato Products
Fruit Juices—Jellies—Jams
Preserves—Lard—Milk
Ice Cream Mix—Milk Drinks
Buttermilk—Bakery Supplies
Soups—Brines—Syrups
Vinegar—Wines
Yeast Products—Flavorings
Fruit Pulp—Extracts
Vegetable Dyes—Baby Foods
Premixing Mayonnaise and Salad Dressings
Sherbet—Honey
Beer—Distilled Spirits
Meat Sauces—Vegetable Oils
Vegetable Butters
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Please send me:
☐ Bulletin B-65—Portable Mixer.
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MIXING EQUIPMENT CO., INC.
1043 Garson Ave., Rochester, N. Y.

MANUFACTURERS OF LIGHTNIN PROPELLER TYPE MIXERS

Food Equipment News

REVIEW OF FOOD PROCESSING EQUIPMENT, ACCESSORIES, AND SUPPLIES

Horizontal Centrifugal Machine

A NEW TYPE of horizontal centrifugal separator or filter is being offered by The Reineveld Corporation, 20 Exchange Place, New York, N. Y. This centrifuge is the invention of a Dutch engineer and has been used in a number of installations in Europe, particularly in the chemical and food products industries. Its outstanding feature is the location of the main bearing in the center of gravity of the revolving mass. This feature eliminates vibration and permits higher speeds than when the bowl or basket is suspended on a shaft between two bearings. Absence of vibration and the rigidity of the shaft enable the motor to be built into the machine and thus reduce the floor space required.

Reineveld centrifuges are furnished

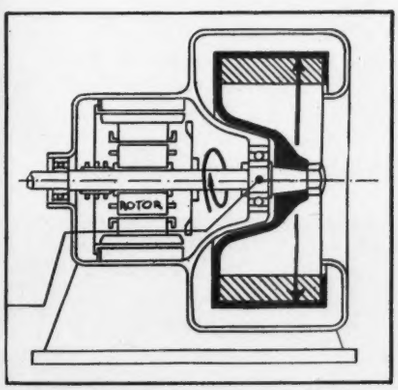
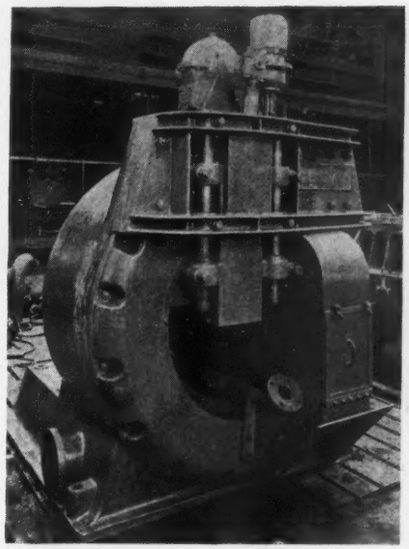


Diagram of Reineveld centrifugal, showing location of bearing at center of gravity of revolving mass.

with either perforate or imperforate bowls in sizes from 400 mm. (16 in.) to 2,000 mm. (80 in.) diameters, to operate at speeds from 900 r.p.m. for the 2,000 mm. to 3,000 r.p.m. for the 400 mm. machines. Solids are discharged at full speed by means of a scraper knife. Control is fully automatic, semi-automatic or manual, as conditions may require. The rigid construction permits rapid feeding without any vibration due to surges. A full charge can be introduced at once, thus permitting classification of the solids—that is, the heavier, coarser particles are thrown to the wall and



Reineveld horizontal centrifugal machine

the finer particles deposited on top, thus furnishing a desirable filter bed.

Cold Storage Insulation

WOOD CONVERSION Co., Saint Paul, Minn., is making "Nu-Wood" sealed cold storage insulations. This insulation consists of units of "Nu-Wood" insulation boards having a double continuous coating of water-proof asphalt on all surfaces and edges, making the insulation resistant to the absorption of moisture or moisture vapors. It is stated that from 3 to 8 in. of this insulation is adequate for insulating cold storage rooms, depending upon the temperature difference between the inside and outside. In placing, the sheets are laid in two or more separate staggered layers to eliminate continuous joints. Sheets are available in thicknesses of 1½, 2, 3 and 4 in. and measure 14⅜ in. by 32 in. Half-size blocks for use in staggering or breaking joints are also available.

Oscillating Granulator

F. J. STOKES MACHINE Co., Philadelphia, Pa., has developed the "oscillating granulator" used for granulating dry crystal masses, processing filter press cake both before and after drying, breaking down materials that have become caked in storage, preparing wet mixtures for drying and similar operations. This is a continuous production machine with an output up to 3,000 lb. per hour, equipped with a built-in motor. It is available in several sizes and in special metals as desired. A dust-tight discharge hopper can be furnished where needed.

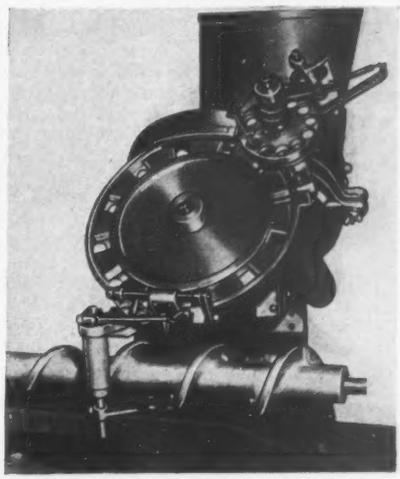
Advantages claimed for this granulator are: Improved screen analysis of granules produced; ease with which screens can be changed; ease of cleaning; adaptability for a wide range of products; low cost operation; and high rate of production.

Bakery Mixer

AMERICAN MACHINE & FOUNDRY Co., 511 Fifth Ave., New York, N. Y., has added the No. 160 to its line of "Glen" bread and cake mixers. This mixer has a bowl of 160 qt. capacity, and a rubber-edged beater that eliminates any necessity for hand-scraping its bowl. It has a variable speed drive and is adapted to both bread and cake work.

Tablet Feeding Mechanism

FOR FEEDING TABLETS, such as compressed salt, citric acid or other materials, into cans or jars, Scientific Tablet Co., 1530 N. Hadley St., St. Louis, Mo., has perfected a mechan-



Feeding mechanism for tablets.

ism that will handle up to 300 units per minute. This mechanism is available in several forms, to suit any style of containers. It will handle tablets or capsules in a wide range of sizes. Materials used in construction are corrosion resistant. Drive is from adjacent conveyor or filler, or from an individual motor.

Corn Cutter

AN ALL-PURPOSE CORN CUTTER, the "Schmidt", is being made by George J. Olney, Westernville, N. Y. This cutter is provided with an adjustment for the cutting depth of knives in relation to the approaching ear so that the knives can be adjusted while the cutter is in operation. It also has a device for the automatic opening of the knives to accommodate each individual ear. The cutting head is without springs or other devices which might cause freezing or tightening of the head from starch from the corn. The cutter is also provided with a feeding device which has no spikes or spurs or other projections to damage to any kernels on the ear.

The capacity of this machine is 125 ears of corn per hour. It requires a 2 hp. motor and weighs 850 lb.

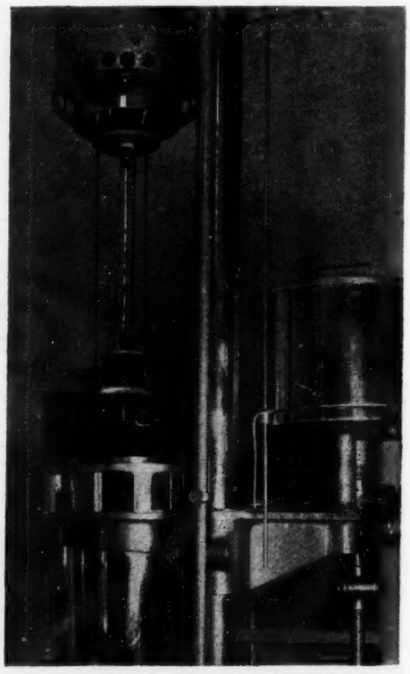
Irradiation Apparatus for Milk

AS SHOWN in the accompanying photograph, an irradiating apparatus for milk has been developed by R. U. V. Engineering Co. This uses a Uviarc quartz lamp, made by General Electric Vapor Lamp Co., which operates on a 440 volt d.c. circuit, consuming 4 amperes at 350 volts across its terminals.

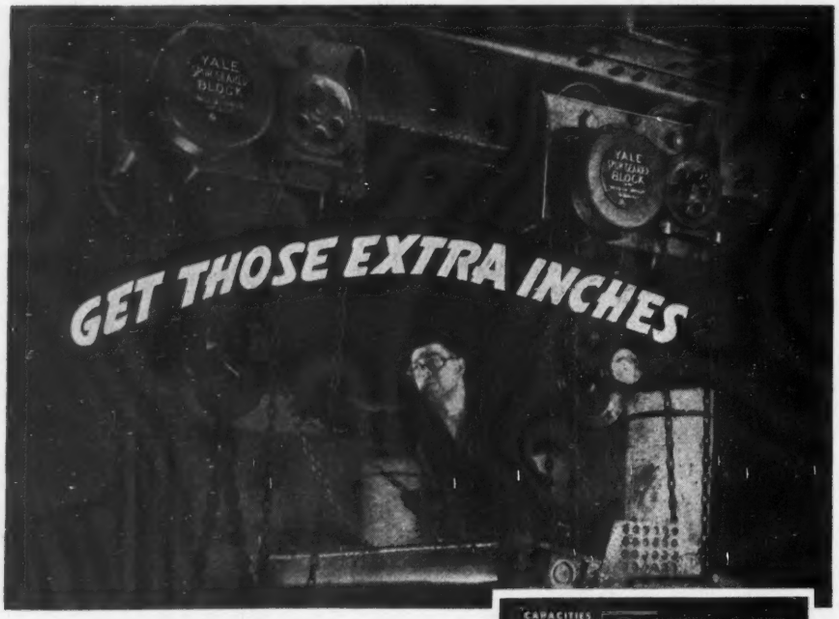
During the treatment of the milk, a 1/32 in. film of milk flows down inside a cylinder that surrounds the lamp. The milk is exposed to ultraviolet radiation for a fraction of a second on each of five concentric 2 in. spillways inside of this cylinder.

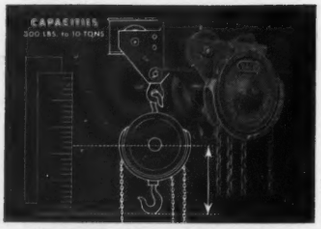
A continuous flow of raw milk to bottled pasteurized milk is made possible through the use of a new continuous electric pasteurizer. In this, approximately 160 gal. of milk an hour flow between a set of electrodes which, under automatic temperature control, hold the milk at 162 deg. F. for 15 seconds.

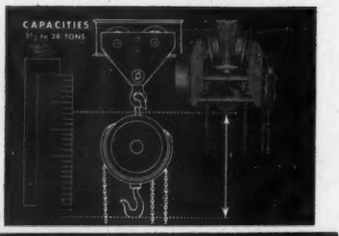
It is claimed that the irradiating device will increase the vitamin D content of milk by 1,000 to 4,000 per cent. As a result, a varying increase in vitamin D can be provided, determined by the difference in hours of sunlight in winter and summer. The vitamin D unit content per quart can be increased to more than 400, instead of 135 U.S.P. units now standard.



Irradiating device for milk.







WITH YALE HEADROOM SAVING HOISTS

If someone told you that you could enlarge your plant without change or expense, you'd probably laugh.

Nevertheless, where faced with a problem of close headroom, you can actually do just that—by installing Yale Headroom Saving Hoists! Put them on the job and immediately valuable inches are added.

For headroom saving of minor proportions, the Clevis Type Hoist is suggested. This hoist saves from 3 to 16 inches depending on the capacity involved. Should this prove inadequate, the Trolley Type Hoist should next claim your attention. This will save from 8¾" to 2' 3" according to capacity. In the event that a still greater saving is required, Yale has developed a hoist that will settle practically all headroom problems—the Rail Hugger. **Providing the shortest headroom available in any hand hoist,** it will save from 18" to 5' 1" depending on capacity. It's Headroom Saver No. 1!

Yale Hoists in every sense of the word, these headroom savers offer all the speed . . . safety . . . and economy that have been setting industrial standards for years. Get further details from your local distributor or write for free literature.

YALE

THE YALE & TOWNE MFG. CO.
PHILADELPHIA DIVISION, PHILADELPHIA, PA., U. S. A.
IN CANADA: ST. CATHARINES, ONT.

Valve positioner for use on diaphragm control valves.

Control Valve Positioner

BRISTOL CO., Waterbury, Conn., has developed a valve positioner for use on diaphragm control valves, to overcome the effect of friction in the valve stem and top. This is a pneumatic device and is for use with air-operated controls when close control is desired and particularly where there is a considerable process lag. It is said to assure a proportionate valve stem travel for even the slightest change in the pressure of the air from the controller.

Control for Pasteurizer

CHERRY-BURRELL CORP., 427 W. Randolph St., Chicago, Ill., is making the "Sentinel Control" a recording thermometer said to incorporate new protective features. The instrument can be sealed after check-testing and the operator cannot reset it below pasteurizing temperatures, although it can be set for higher temperatures needed for processing such products as cream.

Radiant Energy Dryer

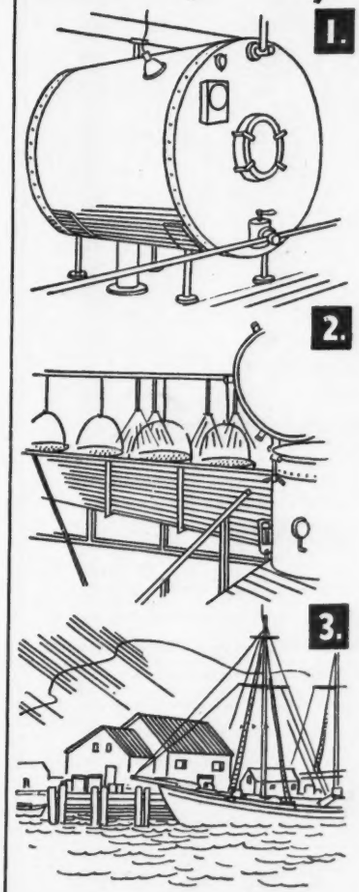
EDWIN F. GUTH CO., 2615 Washington Ave., St. Louis, Mo., has developed a line of "Alzak" aluminum reflectors for use with General Electric 250 watt "CX" drying bulbs. The reflectors are heat-proof and nontarnishable, and are of concentrating or spread beam types. These reflectors find application in drying operations, such as the vacuum drying of food products.

Air-Motored Mixer

ECLIPSE AIR BRUSH CORPORATION, 390 Park Ave., Newark, N. J., has brought out the Type D air-motored agitator for mixing operations. In this mixer, the air motor drives through gears having a ratio of 40-to-1, giving greater power in handling heavy materials. The gear and motor assembly is detachably mounted on a platform adjustable to diameters of 12 to 26 in., in order to fit any container from a 5-gal. can to a 55-gal. drum. The mixer is equipped with a chromium-plated steel shaft from 12 to 27 in. in length, and is provided with chromium plated bronze propeller blades of either the 8-in. six-bladed turbo type or the 10-in. two-bladed air-blade type. Where desired, stainless steel or nickel can be supplied in place of the above metal. Air consumption of the motor is 5 cu.ft. running free at 150 r.p.m.

USE HTH PRODUCTS*

To Cut Spoilage Loss, Guard Quality



1. Keeping milk storage tanks, tank trucks, tank cars, etc. sweet and germ-free is a job for which dependable chlorine sterilizers like HTH Products are ideally suited. No danger of expansion strains, no breakage (of glass-lined tanks), no loss of time in allowing equipment to cool—as when steam sterilization is used.

2. In canneries, the tiniest imperfection in cans may result in contamination of the product by the water in cooling equipment. Cooling water should therefore be kept safe by maintaining a constant residual of available chlorine in the water. HTH Products contain available chlorine in convenient form ranging in concentration from 15% to 70%.

3. Sanitation problems in the fish industry fall naturally into three divisions—(1) purification of plant water supplies, (2) disinfecting and deodorizing containers and equipment, and general plant sanitation, and (3) disinfecting and deodorizing wharves and the decks and holds of fishing vessels. For all these uses, HTH Products offer a convenient means of effective sanitation.

Dairies, canneries—any and all plants that deal with perishable products—face the same hazard of heavy financial loss due to bacterial contamination.

It doesn't pay to gamble with germs—especially when you can combat spoilage by this simple, economical, thoroughly effective means.

Use HTH Products. These famous chlorine sterilizers come to you in convenient powder form. Added to water, HTH Products make fast-killing hypochlorite solutions that keep their strength and are *dependable* in germicidal action. So economical, you can use freely to flush, spray or wipe all surfaces that come in contact with food or beverage products.

Send today for full information about HTH Products and their use.

HTH PRODUCTS

THE MATHIESON ALKALI WORKS (INC.) 60 EAST 42ND STREET, NEW YORK, N. Y.

*HTH PRODUCTS (HTH, HTH-15 and LO-BAX) . . . DRY ICE . . . CARBONIC GAS . . . AMMONIA, ANHYDROUS and AQUA . . . CAUSTIC SODA . . . SODA ASH . . . BICARBONATE OF SODA . . . LIQUID CHLORINE . . . BLEACHING POWDER . . . PH-PLUS (FUSED ALKALI)

Army Subsistance in War

(*Continued from page* 549)

Corps is recited here to show the extent of space and weight which can be saved in the shipment of fresh meat. A quantity of carcass beef of standard Army quality was trimmed and boned. The meat was divided into two classes, one called "roasting and frying" the other called "stewing and boiling." Large pieces, such as chuck and loin, were cut into pieces of average cooking size, and each piece wrapped in wax paper. Each class of meat was packed separately in 50 and 100 pound lots, in flat telescope boxes made of waxed fiberboard. The boxes were leveled under pressure, and the meat frozen solid at a low temperature. Ordinarily 134 cu. ft. of space are required for the storage of 1 ton of regularly frozen carcass beef, but for the beef processed in the manner described, only 32 cu. ft. of space was required; a saving of over 400 per cent. In the boning and trimming process, it was found that 2,650 lb. of beef were required to produce 2,000 lb. of boned-out meat. The tallow and bones which were removed had sufficient commercial value to nearly offset the cost of processing. A skilled laborer could bone out three cattle per hour, or 24 per day.

The use of this system would accomplish a daily saving of 22,000 cu. ft. of shipping space, and approximately 125,000 lb. of shipping weight. It would provide the further advantage of supplying fresh beef better adapted to field cooking than frozen carcass beef and would leave in the home area material of commercial value which would be largely wasted at the front. Forty skilled laborers could process 500,000 lb. daily.

Use of Dehydrated Foods

In a future emergency it is planned to use a substantial proportion of the fruit and vegetable components of the ration in the form of dehydrated products, as the enormous saving in tonnage between either fresh or canned, and dehydrated vegetables, and the difference in storage requirements between them, warrants the maximum use of dehydrated products, consistent with good mass management.

Experimental work since the War has resulted in the production of dehydrated vegetables greatly superior in table quality to those produced during the War. This work has included improvements in machinery, in methods and technic, as well as in selection of the best suited variety of product.

The regular peace time garrison ration of the soldier includes 9 oz. of canned and 12 oz. of fresh vegetables per day. This ration is also the basis for issue during time of war. By substituting 2.1 oz. of dehydrated vegetables, the fresh product can be cut from 12 to 4½ oz., and the canned from 9 to 6¾ oz., and the weight of the entire vegetable component cut from 21 to 13½ oz. For every 1,000,000 men in the field, this will result in a daily saving of 480,000 lb. in shipping weight, and approximately one-third of the cubic space which would be required for the fresh and canned products. Dehydrated vegetables will probably be issued in quantities per man per day approximately as follows:

	Ounces
Potatoes, white	0.81
Potatoes, sweet	0.43
Beans, green string	0.11
Peas, sweet wrinkled	0.16
Corn, sweet	0.26
Carrots	0.12

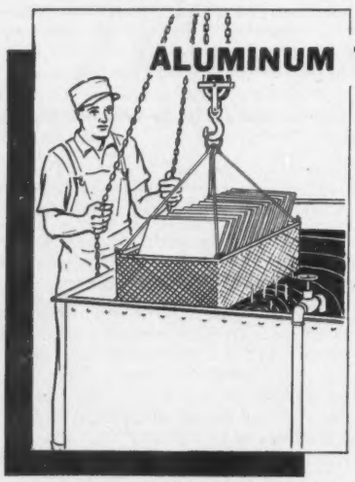
Two more TOUGH Cleaning Problems MADE EASY with Oakite Cleaning

CANNING EQUIPMENT CLEANED FAST

Canning machinery, trays, vats, conveyors are now cleaned with new speed in one meat canning plant. The reason is their recent purchase of an Oakite Solution-Lifting Steam Gun. Attached to their regular steam supply, and using an Oakite material, meat and fat particles are quickly flushed away. Equipment is left clean, sanitary, free of films.

"Nothing like it" says the plant manager for speed and economy. Whatever your cleaning problem . . . whether it is for sanitation or improving equipment efficiency, investigate Oakite materials. They will bring you safety . . . thorough sanitation and economy. Write for data on your work.

ALUMINUM TRAYS CLEANED EASILY



Cleaning aluminum trays in one fresh frozen food plant is easy with two Oakite materials. A short immersion in the first Oakite solution removes the wax deposits which form on the trays. This accumulates from the wax paper and board containers in which the food is frozen. A rinse, and an immersion in the second Oakite solution completely removes a scale deposit picked up on the bottom of the trays from the refrigerating shelves. The result is clean trays at low cost, without any injurious effect upon the aluminum surfaces.

Manufactured only by
OAKITE PRODUCTS, Inc., 26G Thames St., New York, N. Y.
Representatives in All Principal Cities of the U. S.

OAKITE CERTIFIED CLEANING
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

Pumpkin, onion, celery and cabbage in powdered form at the rate of approximately, each..... 0.05

In addition, there will be a regular issue of either fresh or canned similar products in the reduced quantities shown above. It is anticipated that substantial use will also be made of other dehydrated products, such as milk, eggs, fruits, soup powders, etc.

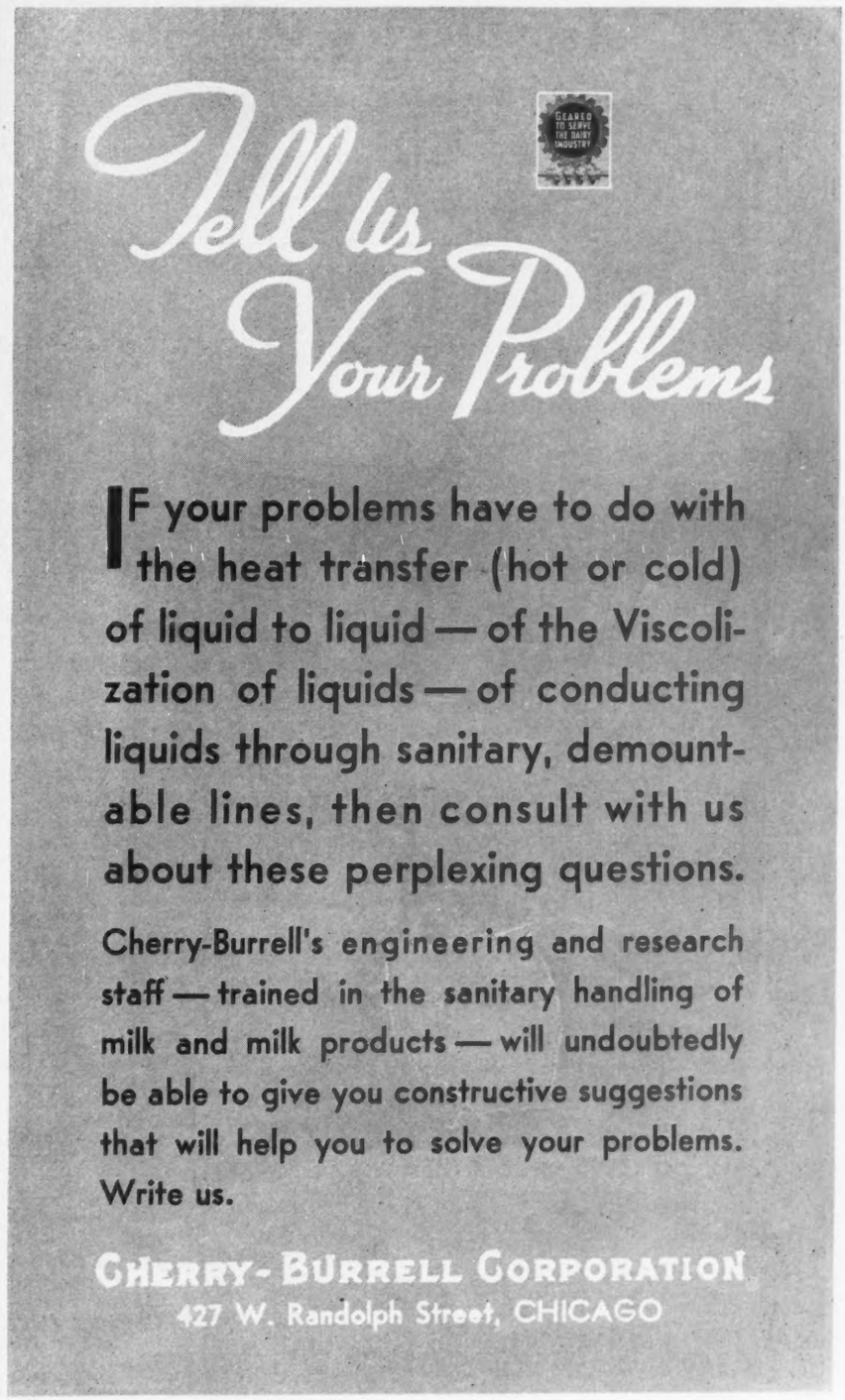
The problem of packaging, so far as concerns protection from gas, could be practically and easily solved by the use of tin containers were it not for the fact that tin is a highly important strategic item. Its availability in war time is dependent upon the sufficiency of ocean transportation and unmolested sea lanes. It is probable that by increased use of glass and paper packages in the Zone of the Interior, no difficulty will be experienced in obtaining sufficient tin for the Zone of Action.

Today the Army is concerned with the organization of combat units which are highly mobile and capable of rapid movement, and every factor which tends to detract from that mobility and speed is being given careful consideration. In line with this, a gasoline-burning field range has recently been perfected which can be used on a truck or quickly and easily removed to the ground. It is much less cumbersome than the old field range, and the use of gasoline as fuel eliminates the necessity for a great quantity of transportation formerly required to carry wood or coal.

An experiment has been under way for the past year in which cooked meals, commercially produced, have been packaged in both individual and institutional size tin containers. This test has included such items as beef and vegetable hash, corned beef hash, beef stew, ham and beans, eggs and rice. The old style hard bread will be replaced by more nutritious and palatable food, such as whole wheat biscuits, and pilot bread. This will be used for reserve ration purposes and in forward areas where the use of kitchens is impracticable. Coffee, in either soluble or concentrated form, will remain the beverage for the front line.

The War Department has recently standardized a chocolate emergency ration which was developed by the Quartermaster Corps. It is molded in four-ounce bars and is composed of skimmed milk powder, sugar, chocolate, oat flour, and a little flavoring. It has a melting point which permits its use in climates where ordinary chocolate would liquify. Its use is not contemplated as a daily, or for a prolonged, diet, but for the distinct mission of bridging over a short period of time during which the regular supply might be interrupted.

The difficulties attending the purchase and issue of subsistence to the United States Army in war will, undoubtedly, be greater in handling the supplies after they have been obtained than in obtaining them. But procurement does present some major problems in quantities, processing and packaging. Their importance is recognized and plans have been made toward their solution. Through the assistance and cooperation of the food industries, particularly commercial research laboratories, and through its own resources, the Army has been able to keep abreast of the ever-changing food world and to revise its plans accordingly. The generous support and cooperation which our people have always given to their armed forces in war, guarantees that the American soldier in a future emergency will be the best fed fighting man on earth.


Tell us Your Problems
GEARED TO SERVE THE DAIRY INDUSTRY
IF your problems have to do with the heat transfer (hot or cold) of liquid to liquid — of the Viscolization of liquids — of conducting liquids through sanitary, demountable lines, then consult with us about these perplexing questions.
Cherry-Burrell's engineering and research staff — trained in the sanitary handling of milk and milk products — will undoubtedly be able to give you constructive suggestions that will help you to solve your problems. Write us.
CHERRY-BURRELL CORPORATION
427 W. Randolph Street, CHICAGO

Food Technology

(*Continued from page* 564)

normal bread obtained by remixing the dough for 1½-2 minutes after fermentation. Too much remixing in air or oxygen breaks down the dough and gives poor bread. By replacing the air or oxygen by nitrogen the effects of excessive remixing are overcome and normal bread again obtained.

Digest from "Dough Oxidation and Mixing Studies: I. The Action of Potassium Bromate in Dough; II. Effects of Remixing After Fermentation; III. The Effects of Proteases and Reducing Substances on Dough When Mixed in Oxygen," by J. Freilich and C. N. Frey, *Cereal Chemistry*, 16, 485, 495, 503, 1939.

Shorter Moisture Determination for Malt

IN DETERMINING MOISTURE, the drying time can be cut from one hour at 130 deg. C. to 20 minutes at 140 deg. C. for barley, and from three hours at 103-5 deg. C. to 15 minutes at 125 deg. C. for malt, by using a solid half-inch thick aluminum plate to replace the usual grid as the shelf in the oven. Time is taken from when the oven regains the designated temperature after loading. The short method checks with the longer within 0.1 per cent moisture. The secret seems to lie in more rapid transfer of heat to the material that is being dried.

Digest from "Application of the Aluminum-Plate Moisture Method in the Malting Laboratory," by S. Stein, *Cereal Chemistry*, 16, 481, 1939.

Suppose YOU Operated This Big W. Va. Plant—
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CHARLESTON LAUNDRY COMPANY
YOU, TOO, WOULD KNOW THAT STERLING DEEP WELL TURBINE PUMPS are
• RELIABLE,
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Mr. J. B. Aicken, Manager of the Charleston Laundry, Charleston, W. Va., is just one of hundreds of laundry owners, mine operators, dairymen, food manufacturers, consulting engineers, city officials, et al, who have proved to their own satisfaction that Sterling's *free floating* drive shaft and *precision assembly* are distinct advantages which bring savings and trouble-free operation.

IF you want to make savings in handling water, or if you have water handling problems, we can help you as we have helped many others. Write today.

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There are also Sterling Vertical Centrifugal Pumps, Sterling Sump Pumps, Sterling Propeller and Mixed Flow Pumps, and Sterling Jet Pumps—Precision Built—Yet Cost No More!

OILS AND FATS

Winterizing Cottonseed Oil

OPTIMUM CONDITIONS for destearinizing cottonseed oil without using a solvent are met by chilling the oil ten hours at 36.5 deg. F. The product will then remain clear when allowed to stand 21 hours at 32 deg. F. For destearinizing in gasoline the preferred gasoline: oil ratio is 1:2 and the temperature should be from 5 to 14 deg. F., the optimum conditions being twelve hours at 14 deg. F. When destearinizing without a solvent it is not advisable to chill in the temperature range from 20 to 32 deg. F., because then the glycerides crystallize in extremely fine-grained crystals and the viscosity of the oil fraction increases. Under these conditions the product cannot be successfully separated into solid and liquid fractions.

Digest from "Destearinizing Cottonseed Oil," by N. I. Kozin and B. I. Azarkh, *Voprosy Pitaniya* 7, 2, 23, 1938 (Published in Russia).

STARCH AND SUGAR

Spontaneous Combustion of Molasses

SPONTANEOUS COMBUSTION of sugar cane molasses that has been stored in open earthen reservoirs has occurred, according to a private report from the General Society of Egyptian Sugar Manufacturers. After exposure to the tropical sun, the molasses absorbed sufficient heat to promote spontaneous combustion.

Steam begins to be evolved and then ebullition commences with the ejection of stringy masses of molasses. As the heat becomes more intense, there are internal explosions, throwing up carbonized material that has lost all characteristics of a fluid. The whole mass of molasses finally solidifies to a porus, carbonaceous mass resembling coke.

The fact that the molasses which showed the greatest tendency to carbonize were all of low moisture content, led to the conclusion that overconcentration was the chief factor involved in the spontaneous carbonization of Egyptian molasses. Instead of boiling the molasses to 44 deg. Bé or over, it was recommended that the concentration be not allowed to exceed 42 deg. Bé. Avoidance of too high a

temperature of the molasses at the beginning of storage was also recommended as a means of preventing this type of decomposition.

Digest from "A Review of the Late Naus Bey's Report on the Spontaneous Combustion of Egyptian Cane Sugar Molasses," by C. A. Browne, U. S. Bureau of Agricultural Chemistry and Engineering. Presented at the American Chemical Society, Boston meeting, Sept. 11, 1939.

Electrometric Sugar Analysis

QUANTITATIVE OXIDATION of reducing sugars by Fehling's solution is easily followed by the standard laboratory electrometer when set to give oxidation-reduction potential readings.

Unlike the Tryller method, the new method measures the oxidation-reduction endpoint directly and has been found to be as accurate as the Tryller, the Munson & Walker method or the Lane & Eynon method. Moreover, it is more rapid than the Munson & Walker method, but unlike either of them the technique does not require confirmation to an exact routine of procedure. Nor does it demand a highly skilled operator in order to yield accurate results. Furthermore, the electrometric method is not affected by the color of the sugar solution.

Digest from "An Electrometric Method for the Determination of Reducing Sugars," by Sidney M. Cantor and Gerald J. Leuck, Corn Products Refining Co., Argo, Ill. Presented at American Chemical Society, Boston meeting, Sept. 11, 1939.

Sugar from Starch

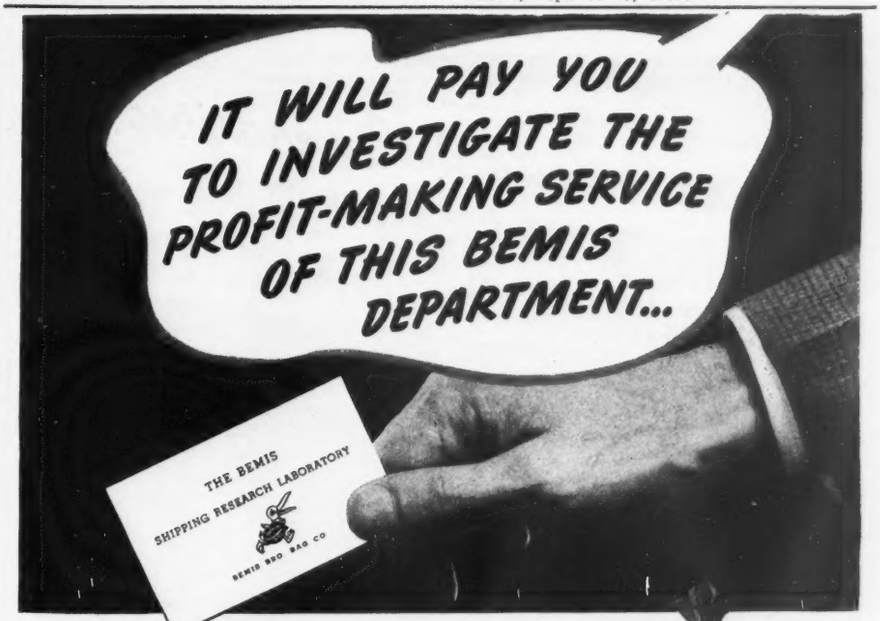
IN SACCHARIFYING STARCH (from manioc root or potatoes), inorganic matter is first removed by washing with pure water or a very dilute inorganic acid in a diffusion battery. As the invention is described in French Patent 837,335 (granted Feb. 8, 1939, to Firmin Boinot and assigned to Usines de Melle, of Melle Deux-Sevres, France), 100 lb. of manioc root will yield about 77 lb. of sugar (glucose). The coarsely ground root is washed with water containing 7 per cent of sulphuric acid, then heated 90 minutes at 145 deg. C. (293 deg. F.) while still wet with the acidulated water. The stated yield is based on root containing 12 per cent moisture.

MISCELLANEOUS

Plant Absorption of Selenium Compounds

SINCE it has been definitely established that the total selenium content of a soil is not a measure of the selenium which will be absorbed by crop plants from the soil, it has become necessary that some method for determining available selenium be devised. As an aid in developing such a method, the availability of some different selenium compounds which have been found to occur naturally in soils was measured. It was found that selenate selenium is the most available form of the element to both crop and "converter" plants. Selenite selenium is bound by the soil and, because of this, its availability to crop plants is somewhat limited. "Converter" plants absorb the selenite selenium quite readily. Iron selenide and elemental selenium are not available to crop plants and are only slowly available to converter plants. No consistent results were obtained concerning the availability of organic selenium, due probably to the volatility of the selenium in the plant extracts used. The availability of certain organic forms of selenium has been demonstrated by other workers, however.

Digest from "The Absorption of Some Selenium Compounds by Crop and Converter Plants," by Oscar E. Olson and Alvin L. Moxon, South Dakota State College, Brookings, S. D. Presented at American Chemical Society, Boston, Sept. 11–15, 1939.



Lower Shipping Costs—Safer Arrival—Increased Sales . . . all are being secured for many food products requiring special protection through better containers developed in the Bemis Shipping Research Laboratory

How long since you've taken your shipping containers to task? Do they "slip up" once in a while?

How are damage claims running? And do customers get many of those annoying "slightly damaged" shipments which often lead to lost business?

Could you secure valuable advertising with a more attractive container design? What is the appearance of your shipments on arrival? Do they create a feeling of respect for your products?

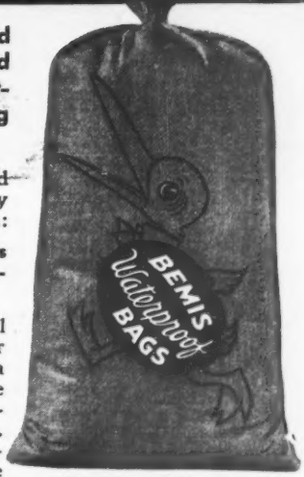
Could you get the same degree of safety with a lighter weight . . . easier handled container?

If you haven't checked your containers this way recently here's a suggestion:

Let the experts of the Bemis Shipping Research Laboratory help you

Get in touch with us. We will make a thorough container analysis for you . . . submit a complete report, and, where needed, make recommendations. There is no obligation.

Or, if you prefer, send coupon for our new brochure giving valuable suggestions for better shipping. Many leading concerns have received money-making suggestions from this practical, experienced department.



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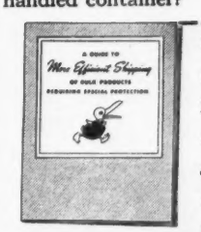

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Street Address _____

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Formulas for Foods

(*Continued from page* 565)

house was always held in readiness as soon as the oysters had been placed on the trays; the electric heaters were turned on and the temperature of the smokehouse raised to 120 deg. F. The smoke smudge was also started before hand, so that the oysters could be subjected to the heat and smoke simultaneously. Under these conditions the oysters developed the desired light brown color very quickly without becoming tough and shrivelled. Four hours' smoking at 120 deg. F. gave the most satisfactory product. A slightly darker product could be obtained by smoking the oysters for the same length of time at 130 deg. F. Some tasters could actually distinguish between oysters smoked for 4 and 5 hours at either of these temperatures.

Two kinds of sawdust were used, birch and alder. The birch sawdust did not produce as dark a color as the alder, but imparted a decidedly sweeter flavor. Degree of smoked flavor and color is a matter of opinion. Most of those who tasted the oyster samples favored the lighter color and milder smoke.

In these experiments, ½-lb. flat cans were used for packing the smoked product. After the cans were filled, from 1 to 1¼ fluid ounces of salad oil was added to each can, which was then exhausted for 15 min. at 10 to 12 lb. pressure in the retort. After double-seaming the cans were processed in the retort for 60 min. at 240 deg. F. They were cooled immediately after cooking and stored for later examination.

Samples prepared in this manner were submitted to the firm interested in the preparation of the product, and were found to be quite satisfactory.

This formula is an excerpt from "Progress Report No. 40, Fisheries Research Board of Canada."

FORMULA NO. 8

Dry Blend Cake Mix For Reduced Operating Expenses

Dry Blend

	Small Batch	Large Batch
Place in a ribbon type blender:		
Granulated Sugar	21 lb.	210 lb.
Salt	12 oz.	7 lb. 8 oz.
16X Vanilla Concentrate	10 c.c.	4 oz.
Coldpressed Lemon Oil	4 c.c.	2 oz.
Coldpressed Orange Oil	2 c.c.	1 oz.
Shortening (glycerinated type)	6 lb. 12 oz.	67 lb. 8 oz.
Add and mix dry to produce a smooth powder:		
Good Cake Flour	18 lb. 12 oz.	187 lb. 8 oz.
Baking Powder	1 lb. 6 oz.	13 lb. 12 oz.
Skim Milk Solids	2 lb. 4 oz.	22 lb. 8 oz.

Remove from machine and place in container for use.

NOTE: If large batches are made in a blender, they should be packed in bags of batch size and stored on skids.

To Use Dry Blend for Batter

	Small Batch	Large Batch
Place in machine bowl:		
Dry Blend	10 lb. 12 oz.	107 lb. 8 oz.
Add all at once and mix 1 minute on low speed and 4 minutes on high speed (3 speed machine):		
Whole Eggs	2 lb. 5 oz.	23 lb. 2 oz.
Scrape bowl and mix 1 minute on second speed then add slowly over a 4-minute period to keep batter smooth:		
Water (variable)	3 lb.	30 lb.

Note: Batter will take full amount of water as given; it may, however, take more. Batter should be quite soft.

This batter may be used for cup cakes, layers, and flat or oblong loaves.

Revolving speed of the 12-foot drums on these EIMCO Continuous Vacuum Filters is controlled by REEVES Motodrives to remove in the shortest time as much sugar-bearing liquid as possible from beet pulp.

● On these EIMCO filters, as in scores of other filtering, heating, cooling, proportioning and mixing operations, REEVES Speed Control results in savings far exceeding its cost. Ease of adjustability encourages operators to change speeds more frequently as variations in weight and consistency of materials occur. Positive and accurate speed settings, *not too fast, not too slow, but just right,* insure the greatest efficiency at every stage in the process. Only REEVES has the complete line of units, models and sizes, the experience in the food industry, the engineering facilities and personnel to solve your speed control problem with the same efficiency and economy. Ask for Catalog G-397, which illustrates and describes many installations in food industry plants.

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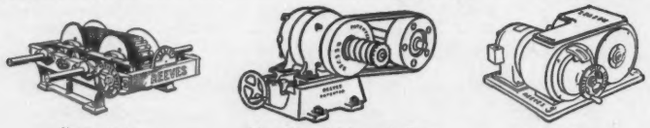
THE 3 BASIC UNITS IN THE MODERN REEVES LINE



Transmission | Vari-Speed Motor Pulley | Motodrive

Reeves SPEED CONTROL

It can be scaled light and gives good volume.

Bake at 410 to 425 deg. F.

Formula from Parker-Broeg, Boston, Mass.

FORMULA NO. 9

Birch Beer Extract (Imitation)

Methyl Salicylate	**106 oz.**
Oil of Sassafras	**18 oz.**
Ethyl Alcohol	**12 gal.**
Water	**6 gal.**
Red Color Solution	**5 oz.**

Dissolve the essential oils in the alcohol. Dissolve the color in the water. Then mix the two. If a mistake is made and the alcohol and water are mixed first, the oils cannot be dissolved but will float on the surface. Also part of the color will fail to dissolve.

Formula from David Algie

FORMULA NO. 10

Benzoate of Soda Solution

Benzoate of Soda	**2 lb. 13 oz.**

Dissolve in 3 quarts of hot water. This may require filtration through cotton to get it clear.

Formula from David Algie

FORMULA NO. 11

Birch Beer Sirup (Imitation)

Imitation Birch Beer Extract	**12 oz.**
Sugar Color	**½ oz.**
Simple Sirup	**1 gal.**
Benzoate of Soda Solution	**½ oz.**

Formula from David Algie

FORMULA NO. 12

Bel Paese Type Cheese

Bel Paese type cheese is a soft white variety of European origin. It possesses a characteristic mild, slightly salty, lactic flavor, and a soft, waxy texture which makes it desirable for both slicing and spreading.

Either good quality raw cow's milk, or pasteurized milk, may be used. A small amount of lactic starter is used, and enough rennet is added to the milk at 104 to 110 deg. F. to obtain the desired "break" in 15 minutes.

When the curd has the desired firmness, it is cut and carefully stirred several times to insure rapid and uniform whey expulsion. When the curd particles have dried sufficiently, the whey is drawn off and the curd dipped into suitable forms which are placed on reed mats.

Draining in the forms requires from five to seven hours and is best accomplished at a temperature of about 80 deg. F. The cheeses are turned occasionally during this period.

After draining, the cheeses are placed in a 16 to 18-per cent salt brine at 54 to 60 deg. F., and held there from 14 to 18 hours. Upon removal from the brine, they are placed in a curing room with a temperature of 38 to 42 deg. F. and a relative humidity of 80 to 90 per cent.

A brownish or near colorless moist layer appears on the surface of the cheese soon after it is placed in the curing room. Occasional washing in a salt brine keeps this coating thin and the rind firm. After about 20 days in the curing room, the cheese is packaged in tin foil or other suitable wrapping. Then each foil-wrapped package is placed in a box and allowed to cure two to four weeks longer at the same temperature, 40 to 45 deg. F.

Formula from Bureau of Dairy Industry, U. S. Department of Agriculture. For details, see circular 522, U. S. D. A.

To Our Customers:

DO NOT BE ALARMED by rumors now current regarding shortage of supplies of Adhesives, Gums, Starches, Dextrines, and other allied products.

This Company announces that it has adequate stocks to insure all its customers of a normal supply of standard materials, and expects to fulfill all its contracts and advance bookings in its usual manner (unforeseen or unusual contingencies excepted).

Recognizing that the steady supply of our products represents a service that is vital to your continuous operation, our first interest is the proper protection of that service—YOUR GOOD WILL—our most valuable asset.

NATIONAL ADHESIVES

DIVISION OF

NATIONAL STARCH PRODUCTS INC.

BOOKS RECEIVED

Food Law Simplified

ARE YOU A VIOLATOR? Published by Laucks Laboratories, Inc., 314 Maritime Bldg., Seattle, Wash., 1939. 16 pages; 4x9 in. Free.

This pamphlet presents in a convenient simplified form the stipulations and regulations of the Federal Food, Drug and Cosmetic Act. Provisions of the law are itemized and classified for quick reference.

World Data on Fruit Canning

FRUIT CANNERS OF THE WORLD. By Clarence E. Birgfeld. Published by the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, D. C., 1939. 29 pages; 5¾x9 in.; paper. Price, 10 cents. For sale by Superintendent of Documents, Washington, D. C.

In the majority of the world markets the addition of the cost of a tin container to that of the fruit places the packaged product beyond the reach of most of the population. And few countries have large-scale canning industries. Yet a large international trade in canned fruits has developed. This pamphlet gives the production, exports and imports of the different factors in this trade.

Evidence of the lead taken by the United States is embodied in the fact that 64.5 per cent of the fruit canned in the world in 1937 was packed in this country, and another 14.5 per cent in Hawaii. Malaya was next with 4.3 per cent, then Germany, 3.7 per cent; Australia, 3.5 per cent; Japan, 3.4 per cent; Canada, 2.1 per cent; United Kingdom, 1.6 per cent; other, 2.4 per cent.

Canning Processes

PROCESSES FOR NON-ACID CANNED FOODS IN METAL CONTAINERS. Bulletin 26-L, fourth edition. Published by National Canners Association Research Laboratory, Washington, D. C. 1939. 39 pages; 5x7¾ in.; paper. Free to canners.

This brings in line with latest knowledge the information on non-acid food processing first published in 1930. The processes given represent the composite opinion of experts in canning technology.

Guide for Meat Packers

ANNUAL MEAT PACKERS' GUIDE 1939. Published by Davis Publications, Daily News Plaza, Chicago. 270 pages; 8¾x11⅛ in.; boards. Free to qualified persons in meat packing and allied industries; price $5 to others.

This is a guide for buyers of meat plant equipment and supplies. By way of added value, it contains a reference and data section and a bibliography.

Pickle, Sauce Processing

PICKLE AND SAUCE MAKING. By Raymond H. Binsted. Published by author, St. Ann's Chambers, Waithman St., E.C. 4, London, England, 1939. 128 pages; 5¾x8¾ in., cloth. Price, 25 shillings.

Formula collectors in the food industries will find in this work several commercial recipes. These, of course, represent British tastes and the directions for making follow British practices. But that doesn't mean they aren't good.

The book includes chapters on principles of pickling and brining; vinegar; spoilage in pickles; gherkins; cucumber or dill pickles; thick sauces; tomato sauce; sauce stability; thin sauce; chutneys; mayonnaise and salad cream; horseradish products; and miscellaneous products. The reader is told how to prepare commercially the different products covered.

PATENTS

Frozen Flesh Foods Coated With an Ice Glaze Containing Benzoic Acid and Having Non-Cracking Characteristics—Robert Henry Bedford, New York, N. Y. No. 2,166,113. July 18, 1939.

Bakery Doughs Cut Into Small Portions and Spread by Automatic Mechanical Means—Paul Kellner, New York, N. Y. to American Machine & Foundry Co. No. 2,166,159. July 18, 1939.

Food Package Cylindrical in Form and Made by Plurality of Wrappings Opened by a Tape Extending Lengthwise the Package Within the Wrappings—Douglas M. MeBean, Canajoharie, N. Y., to Beechnut Packing Co., Canajoharie, N. Y. No. 2,166,171. July 18, 1939.

Margarine Freed From Excess Water by Working and Kneading During Movement From One End of Cylindrical Compartment to Other by Means of Propellers Forcing Mass Through Perforated Plates—Jacob Schaub, Westfield, N. J., to Best Foods, Inc., New York, N. Y. No. 2,166,197. July 18, 1939.

Mashed Potatoes Packaged and Quick Frozen to Retain Flavor and Palatability Over Extended Period of Time—Sterling W. Alderfer, Akron, Ohio. No. 2,166,278. July 18, 1939.

Yeast Grown in Nutrient Solution Containing Guanidine, Hypo-Phosphoric Acid and Guanidinase-Containing Material—Harold H. Browne, Brooklyn, N. Y. No. 2,166,339. July 18, 1939.

Starch Dried in Vertical Vacuum Dryer—Carl Hagen, Park Ridge, Ill., to Corn Products Refining Co., New York, N. Y. No. 2,166,351. July 18, 1939.

Confections Frozen Onto Sticks in Molds on a Continuously Moving Conveyor—William J. Taylor to The Lamson Co., Syracuse, N. Y. Nos. 2,166,380 and 2,166,381. July 18, 1939.

Fruits and Vegetable Juices Expressed in Worm Expeller Type Machine Designed to Discharge Refuse at End of Extractor Housing With Juice Discharge Below the Feed Opening—James J. Horvath, South Bend, Ind., Mary Horvath, executrix. No. 2,166,547. July 18, 1939.

Cereal Foods Fortified in Mineral Content by Addition of 0.5 Per Cent by Weight of Sodium Acid Phosphate, Disodium Phosphate, and Calcium Carbonate Mixture Having pH 7.0 in Solution—Ferdinand A. Collatz, St. Paul, Minn, to General Mills Inc. No. 2,166,797. July 18, 1939.

Glycerine Added to Peanut Butter Prevents Oil Separation and Improves Eating Qualities—Robert Newell Du Puis, Charles William Lenth, and John B. Segur, Chicago, Ill., to Association of American Soap & Glycerine Producers, Inc., New York, N. Y. No. 2,166,806. July 18, 1939.

Peel of Citrus Fruits Scraped by Mechanical Means—Robert D. Wehr, Auburndale, Fla. No. 2,166,883. July 18, 1939.

Vitamin E Product Made to Contain Not Less Than 0.05 Per Cent Manganese—August J. Pacini, Chicago, Ill., to U. S. Vitamin Corp., New York, N. Y. No. 2,167,002. July 25, 1939.

Ground Roasted Coffee Impregnated With Sufficient Water to Swell Ligneous Content to Inhibit Escape of Moisture and Oil Content of Coffee—Charles E. Page, Los Angeles, Calif. No. 2,167,085. July 25, 1939.

Margarine Given Improved Properties Through the Use of Hydrogenated Soya Oil, Sun Flower Oil, and Corn Oil—Carl H. Haurand, North Plainfield and Ralph H. Neal, Bayonne, N. J., and Hans W. Vahlteich, New York, N. Y., to Best Foods Inc., New York, N. Y. No. 2,167,113. July 25, 1939.

Ergosterol Separated From Mother Liquor in Large Crystals—Walter A. Carlson, Minneapolis, Minn. to General Mills Inc. No. 2,167,272. July 25, 1939.

Edible Cup for Ice Cream Given an Interior Coating of Vegetable Fat and Finely Divided Sugar—Nello Frediani, Lake Geneva, Wis. No. 2,167,353. July 25, 1939.

Biscuits Molded From Dough While Passing Between Forcing Roll and Molding Drum—Otto Kremmling, Hamersleben, Germany. No. 2,167,388. July 25, 1939.

Cooked Fish Meal Compressed into Pellets With Smooth Hard Surface for Protection Against Atmospheric Moisture and Insect Penetration—Edgar T. Meakin, San Francisco, Calif. No. 2,167,723. Aug. 1, 1939.

Buttermilk Casein and Some of its Companion Solids Converted Into Smooth Viscous Liquid Coating—Charles G. Harford, Wollaston, Mass. to Arthur D. Little, Inc., Cambridge, Mass. Nos. 2,167,751 and 2,167,752. Aug. 1, 1939.

Food Corrosion Action Upon Metal Containers Inhibited by Small Quantities of Thio-Urea, Allyl Thio-Urea, Cystine, Cysteine, Methionine and Alkali Sulpho-Cyanates in Container Coating—Arthur E. Stevenson and Sylvester E. Flugge, Chicago, Ill., to Continental Can Co. Inc., New York, N. Y. No. 2,168,107. Aug. 1, 1939.

Milk, Fruit Juices, and Similar Liquid Foods Concentrated in "Vapor Mist" Type of Multiple Effect Evaporator—David D. Peebles, Eureka and Paul D. V. Manning, Berkeley Woods, Calif. No. 2,168,362. Aug. 8, 1939.

Butter Produced Directly by Centrifuging Mixture of Cream and Water at Temperature Between 115 and 180 Deg. F.—Peter A. van der Meulen and David Levowitz, New Brunswick, N. J. No. 2,168,376. Aug. 8, 1939.

Food In Containers Fitted With a Valve Closable by Pressure From Within Sterilized by Pulling a Vacuum and Injecting Steam at Such Pressures That an Equalizing External Pressure Must be Used—Samuel Henry Ayers and Charles W. Lang, Philadelphia, Pa., to Crown Can Co. No. 2,168,506. Aug. 8, 1939.

Measurement and Control of Flow In Food Processing Operations

Instruments, principles and practices

A UNIT OPERATION OF FOOD ENGINEERING

Controlling

► Measurement and control of the quantity and rate of flow of fluids through pipes in food plants offer important possibilities for cost reductions and improvements in processes. These are even greater than with measurement and control of temperature and pressure because the manufacturer is given control over his most expensive supplies — steam, water, fuel and the fluid ingredients of his products. In this article is information upon how flow instruments operate, what types are available, what these will and will not do, and what uses food manufacturers are making of them.

This is No. 13 of a series on the unit operations of food engineering.

MEASUREMENT and control of the flow of fluids has come to be an essential in the well managed food plant. Although slower to be adopted than temperature and pressure measurement and control instruments, flow meters and controllers are now being recognized by management, engineers and superintendents as practical tools. They are tools with which to cut costs by accurate determination and proper allotment of plant and plant department expenses, with which to find waste in the use of materials such as water and steam. They are tools with which accurately to control processes so as to improve and stabilize the product produced in the operation. They are tools which make possible continuous processing operations where batch operations were performed before, with lower operating costs and a more uniform product. And they stabilize batch operations so that they may be repeated time after time without variation in the quality of the product produced.

But perhaps we should be more specific. By using flow meters to check steam distribution, the superintendent of a nationally known sugar refinery saved 1,000,000 lb. of steam a month, with $6,000 a year off the power bill. In another plant, savings of $1,500 a year followed the installation of flow meters to measure the amount of high and low pressure steam used in processing. The meters cost $975.

Flow meters are also useful in checking inefficiency in plant equipment. In one instance, an old grain dryer in a food factory was about to be discarded because it was so slow in drying the grain that to operate it was no longer profitable. A flow meter installed on the steam line to this dryer showed the steam consumption to be 26 lb. per pound of grain instead of the 7 lb. for which the dryer was designed. Examination of the dryer to determine the cause revealed scaled heating coils. When the scale was removed, not only did the steam consumption drop again to 7 lb., but the dryer functioned as good as when new and did not have to be replaced.

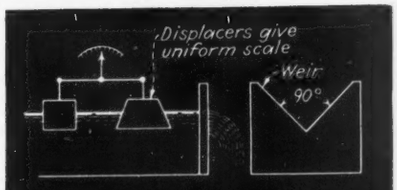


Fig. 1 — Weir, simplest of flow metering devices.

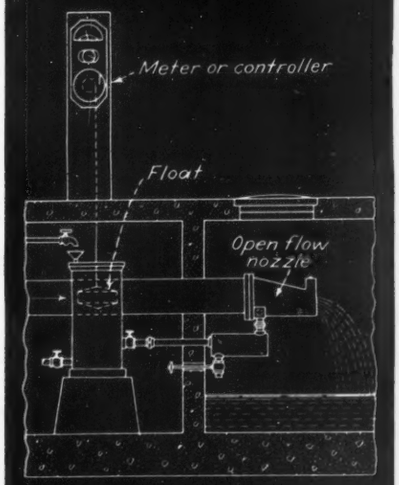


Fig. 2 — Open flow nozzle used in metering waste.

As with steam, flow instruments in water lines will cut the water bill by showing where waste exists and will also reveal defective plant operations. These instruments will indicate troubles in heaters, filters and pumps.

In addition to making new processes possible and improving old ones, flow instruments sometimes incidentally cut operating time and expense. The mixing of one fluid with another by proportioning the rate of flow in two supply lines is an example. Here the mixing is done in continuous operation, eliminating the time, equipment, labor and floor space required for batch mixing.

These cases have been cited to show briefly the possibilities of flow instruments. Much more will be said later about the applications of these instruments in the food industries. But first the principles of construction and operation of flow meters and controllers will be considered. This will provide the background of informa-

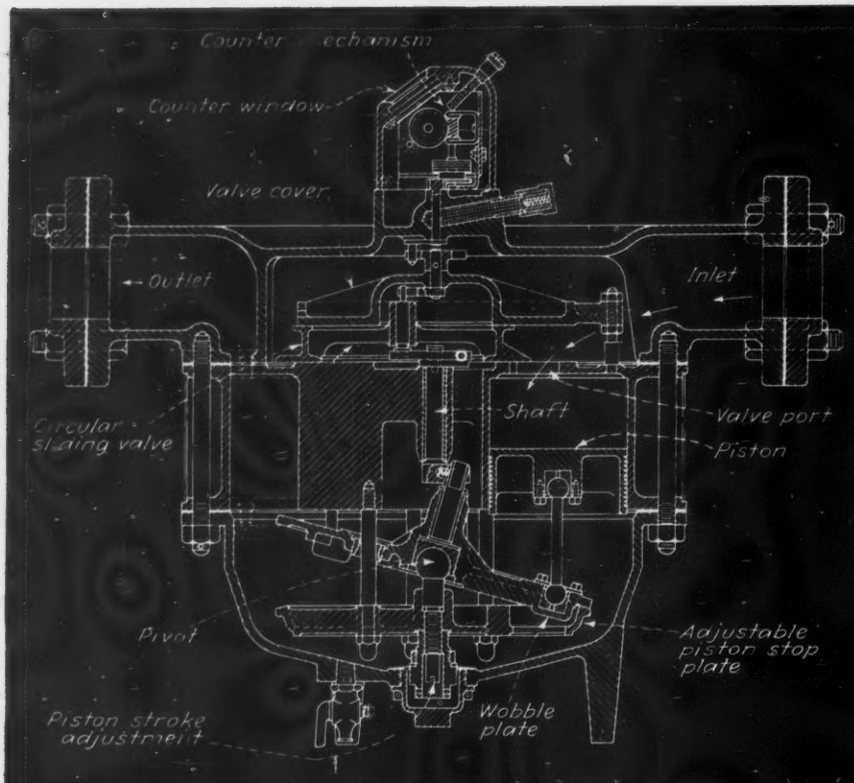


Fig. 3 — Piston displacement meter, used in breweries.

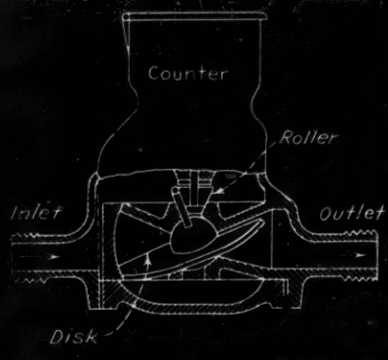


Fig. 6 — Nutating disk displacement meter. The disk wobbles.

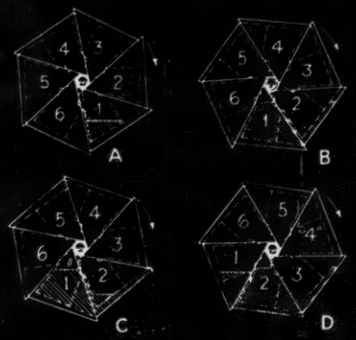


Fig. 7 — Bucket displacement meter for liquids.

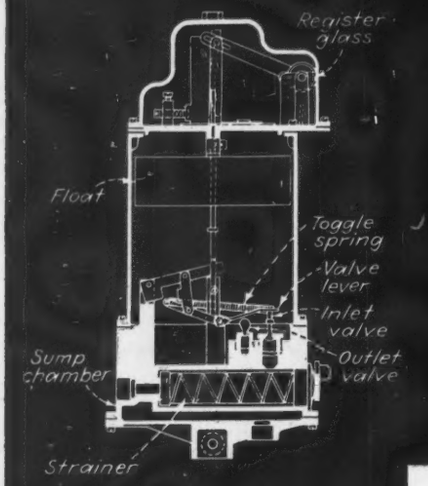


Fig. 4 — Float displacement meter for fuel oil.

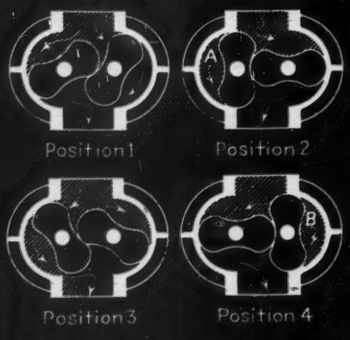


Fig. 5 — Rotating displacement meter, a pump in reverse.

Fig. 8 — Bucket displacement meter for gas.

tion necessary for a complete understanding of the applications.

Before the rate of flow of a fluid can be controlled, it must be measured. So the first element of any flow instrument is a rate of flow detector.

Flow in an open channel can be measured by the simplest, and oldest, of flow metering devices, the weir (Fig. 1). The weir is really an obstruction across the path of flow which backs up the fluid, and the rate of flow is proportional to the height of the crest above the weir vertex. By means of the displacers shown in Fig. 1, a uniform flow scale is made possible.

Akin to the weir is the Kennison open-flow nozzle employed in one of the Builders Iron Foundry flow meters. It is designed to measure flow in partially filled pipes and open channels where there is a wide variation in flow rates. Of self-scouring, non-clogging design and open on top for inspection, it will handle such products as industrial wastes and sewage. This nozzle operates on the same principle as the weir. That is, the rate of flow is proportional to the level of the liquid in the channel ahead of the nozzle. As shown in Fig. 2, a float-operated meter can be used with the nozzle to indicate the rate of flow. A similar system can be used with a weir.

Simplest of the flow measuring elements for use in closed pipes is the positive displacement type. In this type the flow of a certain quantity of fluid through the meter displaces a piston, a rotor, a bucket, a float or a nutating disk at a rate proportional to the volume of the flow. A counter

adds the number of displacements to totalize the quantity of flow.

The construction and principle of operation of the Bowser piston type positive displacement meter is illustrated in Fig. 3. Basically, this meter consists of a series of cylinders which fill and empty in sequence as the fluid flows through. As a cylinder fills, the piston in it is pushed down and a definite quantity of fluid is measured in the cylinder. Then as another cylinder fills, its piston pushes the wobble plate down at another point and causes the piston in the full cylinder to rise and discharge the fluid in its cylinder. The motion of the wobble plate as the cylinders fill and empty drives, through a nutating motion, a sliding valve which controls the intake and discharge of fluid into the cylinders and also drives a counting mechanism which totalizes the flow. In the meter illustrated, the fluid is admitted to each cylinder when the sliding valve is in such a position that the valve port is outside the valve. And the fluid is discharged when the port is inside the valve. This meter has found wide application in the brewing industry.

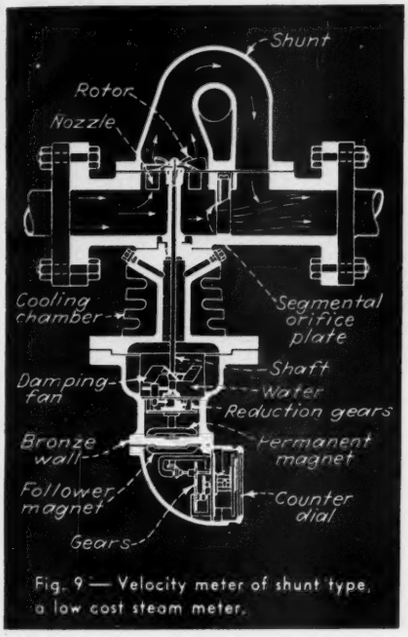


Fig. 9 — Velocity meter of shunt type, a low cost steam meter.

A float type of displacement meter is shown in Fig. 4 In this instrument, made by Fluid Meters, Inc., a float rises as the meter body fills. At the top of its travel, the float trips a mechanism which closes the inlet valve and opens the outlet valve. Then as the fluid discharges, the float drops, the outlet valve closes, the inlet valve opens and the cycle is repeated. Movement of the float operates a counter to totalize the flow. This meter was designed for metering fuel oil supplied to an oil burner.

In Fig. 5 is seen a rotating displacement meter, which looks like, and in like, a rotating pump. But in this case the movement of the fluid drives the impeller, rather than the impeller propelling the fluid. The two impellers, or rotors, are fixed in relation to each other by a pair of gears on their shafts, these gears transmitting to each impeller the power created by the flow of the fluid against the other impeller. The operation of the meter is shown in four steps in the illustration. In position 1, the liquid is filling the space above the impellers and is causing both impellers to rotate. As they revolve in the cylinder, the tips of one impeller close off the space *A*, position 2, which contains a definite amount of liquid. As the impellers turn toward position 3, space *A* is opened and the measured quantity of liquid passes into the discharge line, while space *B*, position 4, is enclosed by the other impeller. Then space *B* is opened and its measured contents discharged. So spaces *A* and *B* are each filled and emptied twice for each complete revolution, measuring a volume equivalent to four times *A*. By a calibrated register attached to the meter shaft, the volume of flow is recorded. This particular meter is a Roots-Connersville Blower Corp. instrument and is recommended for ac-

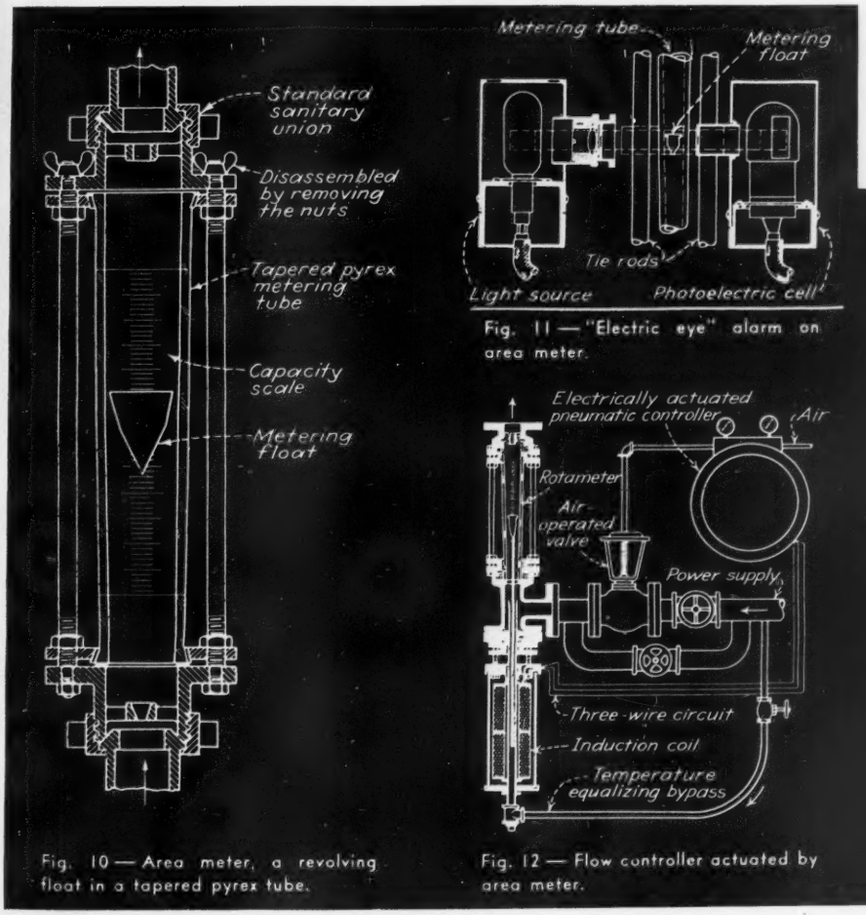


Fig. 10 — Area meter, a revolving float in a tapered pyrex tube.

Fig. 11 — "Electric eye" alarm on area meter.

Fig. 12 — Flow controller actuated by area meter.

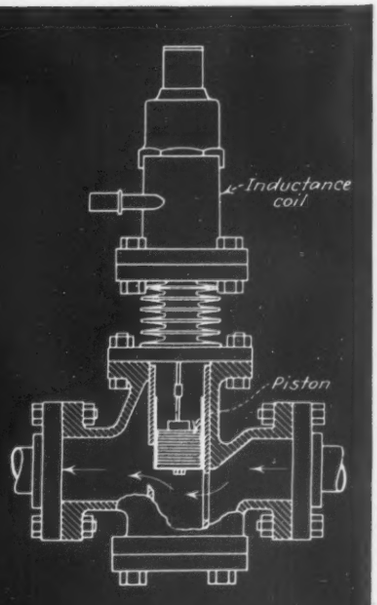


Fig. 13 — Piston area meter varies inductance in coil.

curate measurement of large volumes of liquids. Capacities range from about 20 to 2,800 gal. per min., and larger in special sizes.

Since the rotation of the impellers in this type of meter is caused by and varies with the flow of the fluid through the meter, the unit may be used also as a fluid motor to drive a pump or feed device which handles another fluid in a desired ratio to the flow of the initial fluid. As in other positive displacement meters, accuracy is maintained in this meter over a wide range of flow rates.

Several applications have been made in the food industries of the nutating disk piston type of positive displacement flow meter illustrated in Fig. 6. Made by Neptune Meter Co., the meter illustrated consists of an outer main casing in the bottom of which is the measuring chamber. This chamber contains a circular disk piston that nutates, or rocks, about a spherical center as an axis as the fluid flows through the meter. This nutating action causes the upper end of the spindle at the center of the disk to describe a circle and thereby drive a counting mechanism. The piston is machined to a liquid tight seal in the chamber, and no liquid can pass through without displacing the piston. In each complete cycle of nutation, the piston discharges a volume equal to the capacity of the chamber. Flow through the meter is continuous and non-pulsating.

This meter, like some other positive displacement meters, can be equipped not only with a flow totalizer but with an automatic shutoff which stops the flow when a predetermined amount has passed through the meter. This is a mechanical arrangement which trips and closes a valve in the flow line. This type of meter can also be used to ring a bell when a predetermined amount of fluid has passed through, or to operate an electric switch to control an electrically powered valve. The accuracy of this meter is placed within ½ of 1 per cent by Neptune.

Still another type of positive displacement meter is the rotating bucket unit, the impeller of which is shown in Fig. 7. Liquid enters the meter at the axis, filling bucket 1 (*A*, Fig. 7). A baffle holds the water in one part of the bucket until that section is filled, then allows it to overflow into the other part of the same bucket. As bucket 1 fills, the weight of fluid turns the rotor and brings bucket 2 under the nozzle, and this rotation is continuous. As bucket 2 is filling, bucket 1 begins to discharge at the outer circumference of the rotor. To provide a balanced rotation, bucket 1 is not emptied completely until bucket 3 is being filled (*D*, Fig. 7). This rotor is mounted in a case equipped with a flow register driven by the rotating shaft, and the unit is made by American District Steam Co. Built in capacities from 250 to 12,000 lb. of water an hour, this meter is used to measure steam flow by registering the amount of condensate produced, a pound of steam producing a pound of condensate. The accuracy accorded to the meter is within 1 per cent for all ranges of flow from zero to 150 per cent of rated capacity.

A bucket type of rotary displacement meter also finds application in metering gas. In this unit (Fig. 8), the buckets rotate in a liquid seal. The gas being metered enters at the axis of the rotor and rises into the buckets, lifting them from the liquid seal and turning the rotor. As the buckets rotate, they are immersed in the liquid and the gas is forced out into the discharge line at the top of the meter. So on each revolution of the rotor, each bucket measures a definite volume of gas, and a counter on the rotor shaft totalizes the flow.

Another class of flow meter is the velocity type employing a rotating element such as a propeller, helix or cup shaped elements placed in the line of flow. In these instruments the speed of rotation is proportional to the rate of flow and the number of

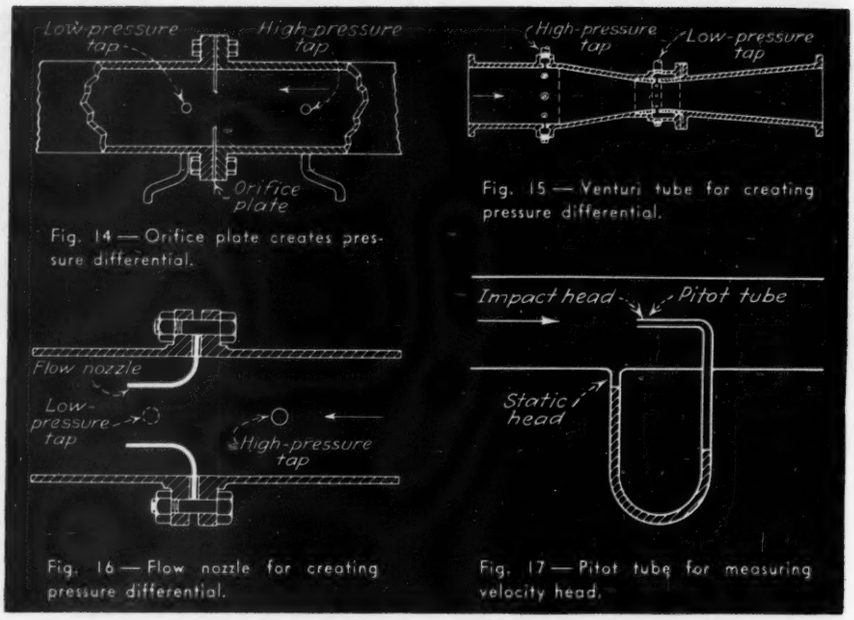


Fig. 14 — Orifice plate creates pressure differential.

Fig. 15 — Venturi tube for creating pressure differential.

Fig. 16 — Flow nozzle for creating pressure differential.

Fig. 17 — Pitot tube for measuring velocity head.

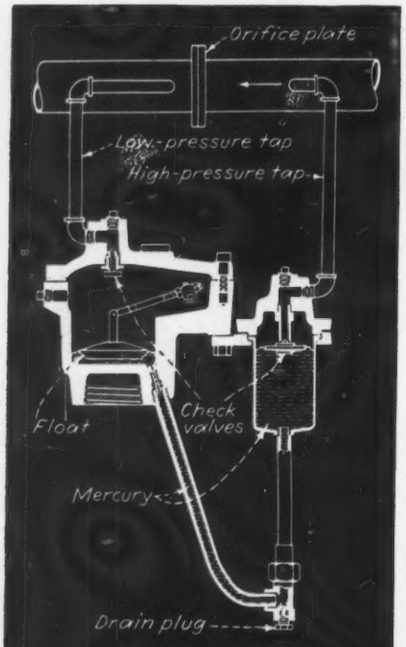


Fig. 18 — Mercury in U-tube operates float to measure pressure differential.

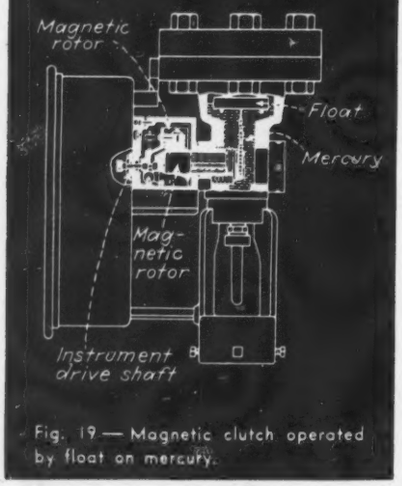


Fig. 19 — Magnetic clutch operated by float on mercury.

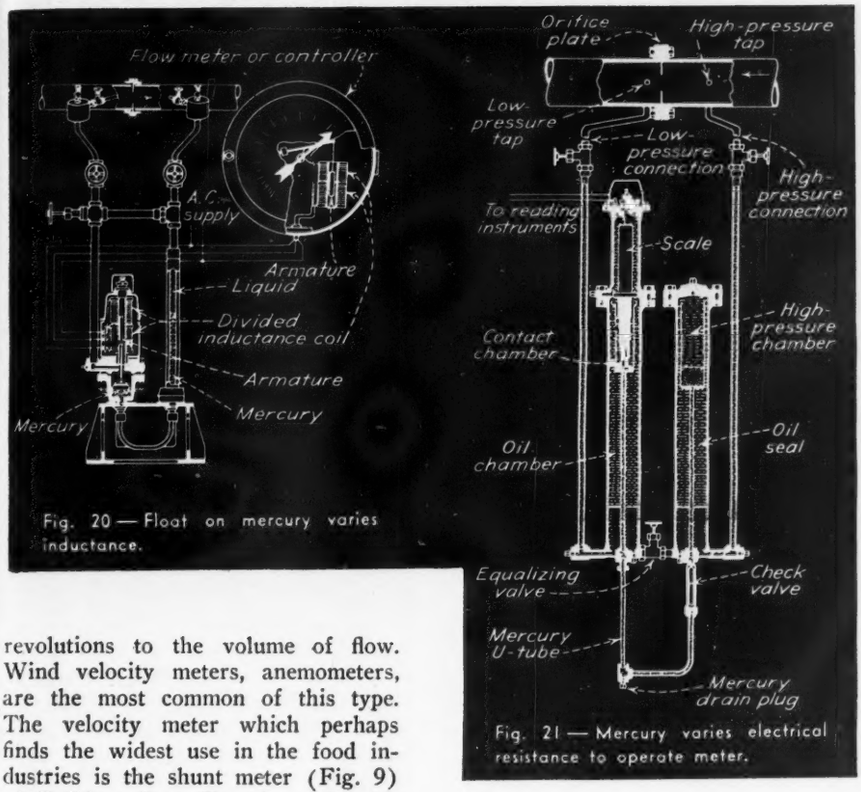


Fig. 20 — Float on mercury varies inductance.

Fig. 21 — Mercury varies electrical resistance to operate meter.

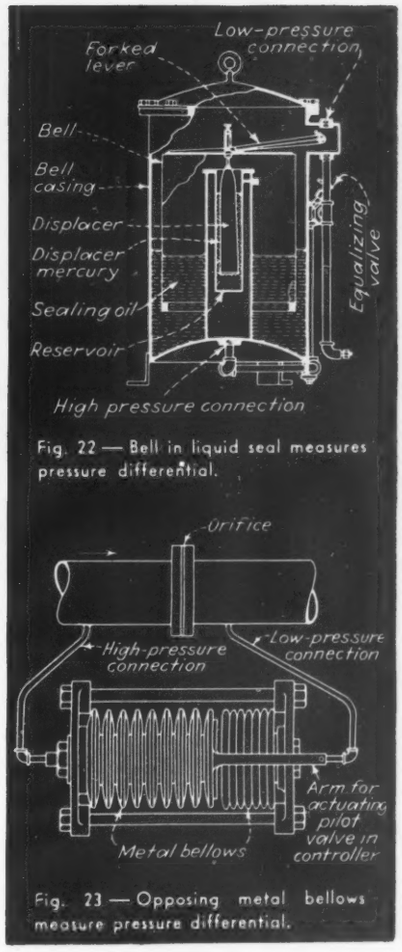


Fig. 22 — Bell in liquid seal measures pressure differential.

Fig. 23 — Opposing metal bellows measure pressure differential.

revolutions to the volume of flow. Wind velocity meters, anemometers, are the most common of this type. The velocity meter which perhaps finds the widest use in the food industries is the shunt meter (Fig. 9) of Builders Iron Foundry. In this meter, an orifice plate constricts flow through the body of the meter and forces a portion of the flow through nozzles, over the blades of a rotor, through a shunt and back to the main flow at the outlet of the meter. This drives the rotor at a speed proportional to the rate of flow and the rotor, in turn, drives, through a magnetic coupling, a counting mechanism. To increase the accuracy, a damping action on the rotor is exerted by a fan which rotates in water. This meter will handle either steam, air or gas. It is relatively simple, which makes it also relatively inexpensive.

Yet another type of flow meter is that utilizing a variable orifice, the opening of which is proportional to the rate of flow through the orifice. These are generally referred to as "area" meters. Figure 10 shows a simple and inexpensive area meter made by Fischer & Porter and Schutte & Koerting. This meter consists of a tapered pyrex tube set in a vertical position with the large end at the top. Inside this tube is a free plumbbob-shaped float which "rides on" the liquid flowing through the tube. If the flow is small this float will be near the bottom, or small end of the tapered tube. If large, the float will be near the top, or large end. For each rate of flow there is a definite position of the float, so its position relative to graduations on the transparent tube is a measure of the rate of flow. To keep the float in the center of the tube so that it does not strike the sides, it is caused to rotate by slantwise slots in its head. This rotation also throws off foreign particles and bubbles which might otherwise cling to the float and change the calibration of the instrument.

In its primary form, this instrument would not control flow. But two auxiliaries have been attached to it, one to set off an alarm and the other to control the rate of flow. To operate an alarm, a photocell is mounted on one side of the meter tube and a light source on the other, so that light passes through the tube and through fluid being metered except when the float is in the way (Fig. 11). The blocking of the light by the float deenergizes the photocell, cutting off the current to a relay and causing a bell or other alarm device to fuction.

The means by which the instrument is made to operate a controller or a remote reading instrument is illustrated in Fig. 12. As shown, the instrument is equipped with a coil, the induction of which is varied in accordance with the rate of flow by an armature attached to the float in the metering tube. This coil is arranged in a bridge circuit with a coil in the remote reading instrument or controller. Also in the circuit is a null type galvanometer relay system for operating a drive mechanism. As the position of the armature attached to the float varies, the galvanometer becomes unbalanced and the drive mechanism moves the armature in the remote instrument or controller until a balance is again attained in the induct-

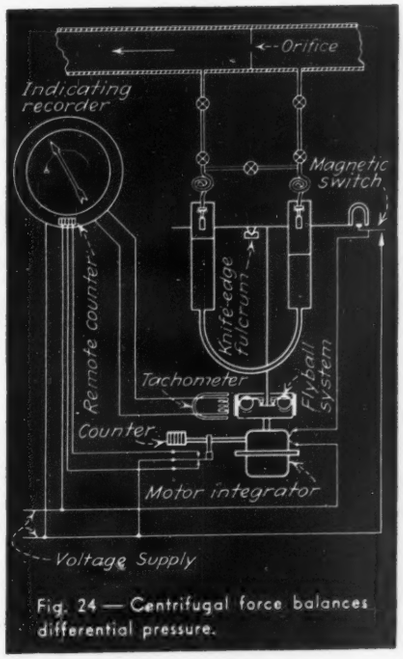


Fig. 24 — Centrifugal force balances differential pressure.

ance bridge circuit. This movement of the armature operates a pen in a recorder or pointer in an indicator and will also actuate a pneumatic flow controller to operate a valve in the flow line, as indicated in Fig. 12. The instrument can also be employed to actuate an electric flow controller.

When this float type of area flow meter is used on opaque liquids one of two special constructions is employed. In one the metering float is connected to a piston in a transparent cylindrical tube extending above the tapered tube. This piston moves with the float, and since it fits its tube closely, it is visible in an opaque fluid.

The other method of metering opaque fluids with this type of instrument is to use a cylindrical metering tube with a tapered pole inserted in it. An annular-ring type of float moves up and down over this pole to vary the orifice area in proportion to flow. This ring fits the tube closely and may be seen in an opaque fluid.

Another type of area flow meter has a piston which moves up and down in its cylinder to vary an orifice opening. A meter of this design, made by Brown Instrument Co., may be seen in Fig. 13. The weight of the piston is balanced against the pressure drop across the orifice, so that the position of the piston is dependent upon the rate of flow through the meter. And the position of the piston is transmitted electrically by the inductance bridge principle to a recorder, indicator or controller. There is a divided inductance coil in the meter body, the armature in this coil being shifted by the piston in accordance with the rate of flow. The other inductance coil of the bridge is in the indicator, recorder or controller. The armature of the second coil follows that in the first to maintain a balanced inductance in the bridge circuit, and it is employed to operate a pen or pointer or actuate a controller.

This type of area meter is especially suitable for the measurement and control of viscous fluids, such as molasses, which cannot be successfully measured by the usual type of orifice meter because of practical difficulties in transmitting the differential pressure through static pressure lines to the meter body. The meter will also measure water, air and other gases in small pipe lines. Changes in the capacity of this type of meter can be made by adjusting the weight inside the hollow piston or by installing a new orifice sleeve.

In principle, the area meters just described operate with a constant pressure differential in the meter regardless of the rate of flow. This is the opposite of the orifice and venturi type of flow instruments, to be discussed shortly, as these operate on a varying pressure differential.

Before describing the differential pressure instruments, of which there are several types, mention will be made of some flow metering methods which as yet have found little or no application in the food industries, but which might possibly be employed. These include the Thomas meter, used for measuring the flow of gas, which adds electrically generated heat to the fluid to raise its temperature a small but definite amount. Measurement of the quantity of electrical power required to raise the temperature then gives a measure of the quantity or rate of flow. An analogous metering method is to add a chemical at a constant rate and, by measuring the concentration of the chemical at a point downstream, determine the rate of flow. This has been used in hydro-electric survey work with a recording ammeter measuring the chemical concentration.

Now we come to the last type of flow meter to be considered, a type which has found wide application in the process industries. We refer to the differential-pressure meter.

In this, a differential in pressure within the flow line is produced by a constriction in the line. This constriction may be an orifice (Fig. 14), a venturi tube (Fig. 15), or a flow nozzle (Fig. 16), the latter being something of a cross between an orifice and a venturi tube. In Fig. 14 is seen how the flow is constricted to a narrow column as it passes through the orifice. The same principle applies to the venturi and flow nozzle. Upstream of the orifice, the pressure is that of the line, and it is there that the high-pressure tap of the flow meter is located. As the fluid passes through the orifice, its velocity increases and its pressure drops in accordance with the laws of physics, so that there is a pressure differential across the orifice. Now for a given flow line and orifice, the faster the flow, the greater will be this pressure differential, so measurement of the differential gives a measure of the rate of flow.

Rate of flow can also be determined by measuring the impact pressure or velocity head of a fluid flowing in a pipe. This is done with an impact pitot tube (Fig. 17). The faster the flow, of course, the greater the velocity head. In the case of a compressible fluid, a gas, the static head must also be taken into account, as in Fig. 17. There a U-tube manometer measures the difference between the static and impact heads to give the velocity head directly.

Flow mathematics are something for only specialists in flow meter

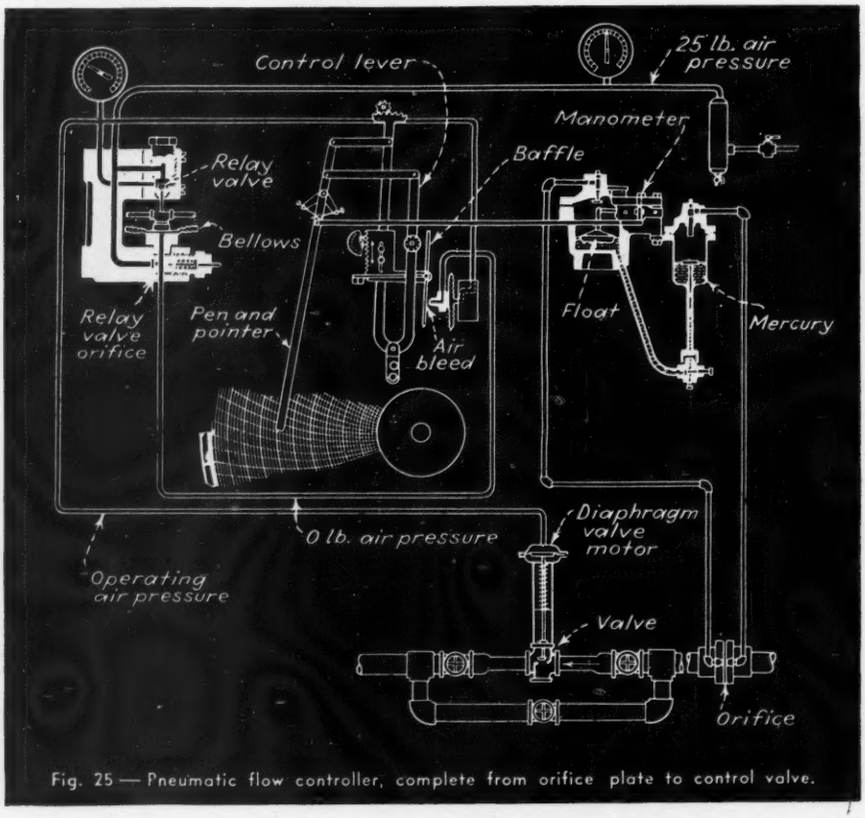


Fig. 25 — Pneumatic flow controller, complete from orifice plate to control valve.

design to play with, but flow equations show that the rate of flow is proportional to the square root of the differential pressure in differential pressure meters and of the velocity head in pitot tube meters. This will explain the square root scales on some meters and special construction of others to eliminate or compensate for the square root factor.

But the important point for the instrument user to understand is that the differential pressure varies with the rate of flow through the orifice, venturi or flow nozzle and that it is this pressure differential which operates the flow meters and controllers.

No doubt there is a question in the minds of users of instruments as to when to employ an orifice plate, a venturi tube or a flow nozzle, and what the relative merits of these differential pressure producing devices are. The orifice is the most widely used, being employed wherever it will function satisfactorily because it is low in cost. It is the most acceptable for general applications where clean non-viscous fluids of a non-volatile nature are to be metered.

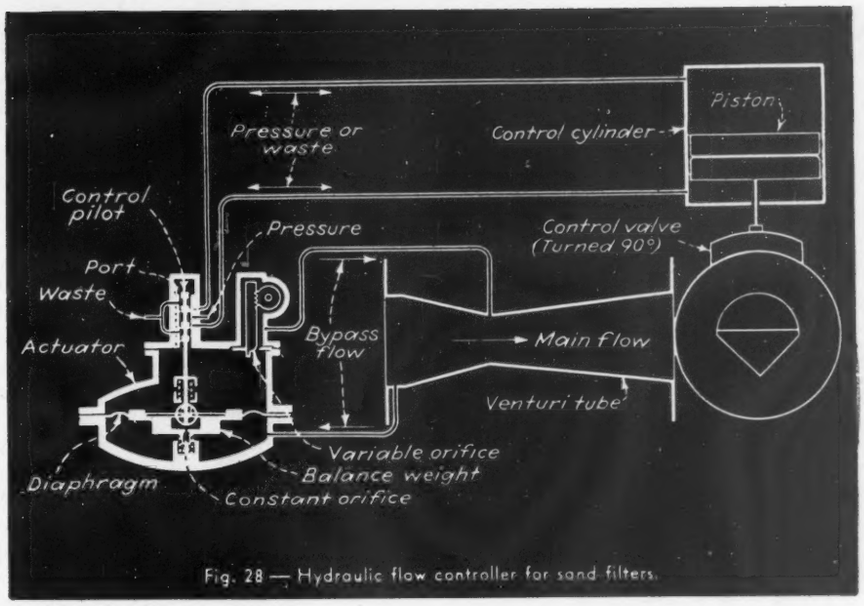


Fig. 28 — Hydraulic flow controller for sand filters.

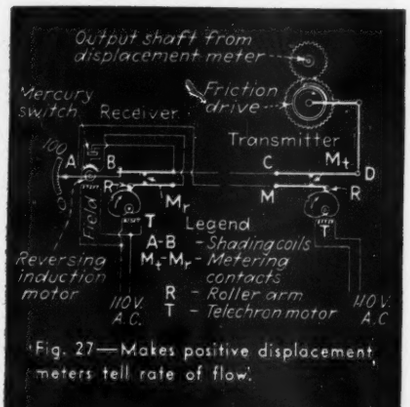


Fig. 27 — Makes positive displacement meters tell rate of flow.

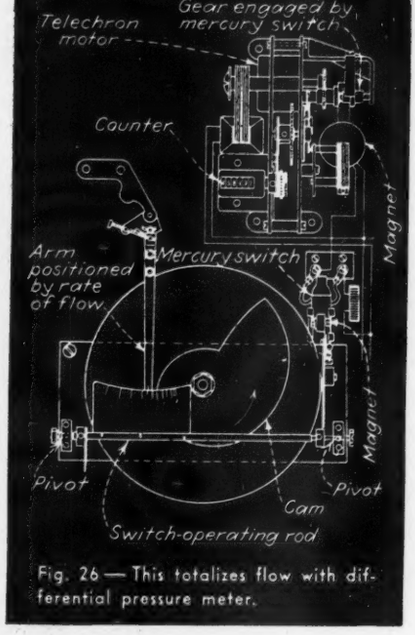


Fig. 26 — This totalizes flow with differential pressure meter.

The flow nozzle finds application in handling high capacities and high pressures without resorting to special meter ranges and excessive pressure drops. It will handle approximately 60 per cent more flow than a flat edged orifice of the same bore. A flow nozzle is more expensive than an orifice plate but not so costly as a venturi tube.

When liquids being metered contain solids or entrained gas in suspension or are of a volatile nature, the venturi tube is useful. A venturi tube installed in a vertical line with flow in an upward direction will prevent excessive formation of gas in a volatile liquid due to agitation and will dispose of gas formed downstream of the constriction without interfering with the measurement. Special piping methods are also used to take care of specific problems such as sediment in a flowing fluid, entrained vapor in a liquid or condensate in a gas, extremely high temperatures and other problems. Because of the higher cost of manufacture and calibration, the venturi tube is much more expensive than the orifice plate. A larger non-recoverable pressure drop is introduced in the flow line by an orifice or flow nozzle than by a venturi tube, but this factor is usually greatly outweighed by other considerations.

As for accuracy of measurement with the orifice plate, the flow nozzle and the venturi tube, there is little difference under conditions suitable to the best performance of each.

To transmit the pressure differential into a rate of flow reading or into the operation of a controller, various devices are used. Perhaps most common is the mercury U-tube float meter body (Fig. 18). In this element, which is really a special form of U-tube manometer, the differential in pressure across the orifice, venturi or flow nozzle, applied through connections between the meter body and the flow line, causes the mercury level to rise and fall in a float chamber. The position of the float buoyed up by the mercury varies with the rate of flow, and this float operates a rate of flow indicator, recorder, or controller. Check valves in the meter body prevent the mercury from blowing out of the meter into the flow line. And frequently a liquid seal in the high and low pressure taps above the mercury is used to prevent contact of the mercury with the fluid being metered.

A method of eliminating the float shaft stuffing box from high-pressure flow meters is employed by C. J. Tagliabue Mfg. Co. In these instruments the float in the mercury U-tube turns, through a chain, a magnetic rotor (Fig. 19). This rotor, then, moves a second magnetic rotor outside the housing of the first rotor to operate the meter. With this arrangement, no shaft extends through the U-tube meter body.

Another design of mercury meter body, used by Brown Instrument Co., utilizes the float to vary the position of an armature, and hence the inductance, in a divided inductance coil (Fig. 20). The coil is in an inductance bridge circuit the same as that used in the Brown area meter (Fig.

13). So the armature in the coil of the indicator, recorder or controller follows that in the coil of the meter body and its position varies with the rate of flow. Remote transmission of the meter readings is an advantage of this unit.

Equally interesting is the principle of operation of the electric resistance flow meter of Fig. 21. Developed by Republic Flow Meters Co., this unit utilizes a meter body in which the mercury level in a U-tube varies with the pressure differential across an orifice in the flow line. As the mercury rises in the low pressure leg, it rises in a "contact chamber" where it engages the resistance element, or scale, and progressively reduces the resistance in the electrical circuit, thereby increasing the current to the indicating, recording or controlling instrument. The resistances are so divided that the conductance of the circuit corresponding to any given contact is directly proportional to the flow of fluid in the pipe. In other words, the square root factor is taken out by the construction of the instrument.

Another means of measuring the pressure differential across an orifice is with a liquid or mercury sealed bell. The Ledoux bell employed by Bailey Meter Co. is illustrated in Fig. 22. The bell, which in reality is a special type of float, is immersed in the sealing fluid. The high pressure connection is inside the bell, the low pressure one outside, so that the differential causes the bell to rise or drop in accordance with the rate of flow. The bell, then, operates the recorder, indicator or controller, as does the float in a mercury U-tube instrument. The bell is frequently used where the differential pressure is low, and bells of more simple construction than the Ledoux unit are available.

One method of eliminating the square root scale is seen in the construction of this bell. There is a displacer, immersed in mercury, which is of such a shape that the buoyancy is not directly proportioned to the depth of immersion. The variance in buoyancy is such as to eliminate the square root factor from the flow reading. This displacer also exerts a dampening action on the movement of the bell for greater accuracy. A method of eliminating the square root factor with the float type mercury U-tube meter body consists of using a mercury chamber of such a shape as to accomplish the same thing as the displacer in the Ledoux bell.

A differential pressure sensitive element of the bell type made by Bristol is said to respond to pressure changes of a fraction of 0.001 in. of water. This unit consists of an inverted oil sealed bell balanced through a lever arm by means of a helical spring. A unit of this type makes possible measurement and control of fluid flows so small as to produce but little differential in pressure across an orifice. And this particular sensitive element is being used in conjunction with a pitot tube to measure and control the flow of gas.

Yet another sensitive element can be employed in the orifice type of flow meter to measure the pressure differential—the metal bellows. Shown in Fig. 23, one bellows is connected to the high pressure side of the orifice, and an opposing bellows to the low pressure side. Pressure variations cause the two bellows to move an arm which actuates the flow instrument.

Differential pressure can also be measured with two helical pressure springs of the type used in pressure meters. One of these elements is connected to the high pressure side of the orifice, the other to the low pressure side. And the free ends of the two elements are connected by a linkage, movement of which is in accordance with the difference in the pressures in the two elements. This movement actuates an indicator, recorder or controller.

Something new in flow meter design was incorporated in the unit of Fig. 24, developed by Leeds & Northrup Co. This consists of a mercury U-tube suspended on a fulcrum so that it tilts as the level of the mercury shifts in the legs in response to variations in the pressure differential. As the U-tube tilts it opens and closes a magnetic switch that controls a motor driving a flyball centrifugal unit connected to the U-tube and exerting a force which opposes titling of the tube. As the switch closes the motor speeds up, increasing the centrifugal force, until it balances the U-tube and causes the switch to open. Then the motor slows down until an unbalance again exists, when the motor switch closes. This cycle of operation is continuous. In this meter the motor is the flow integrator. Geared to it is a counter which, by totaling the revolutions of the motor, records the flow. An electrically connected counter will provide remote reading. And an induction tachometer will operate an indicator or recorder. It is also possible to use the instrument to operate a flow controller. An error of not more than 0.5 per cent at 100 per cent flow is guaranteed for the meter by Leeds & Northrup. The unit is comparatively expensive.

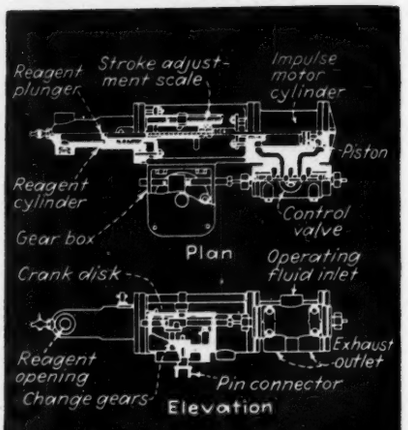


Fig. 29 — Injects one fluid into another in proportion to rate of flow.

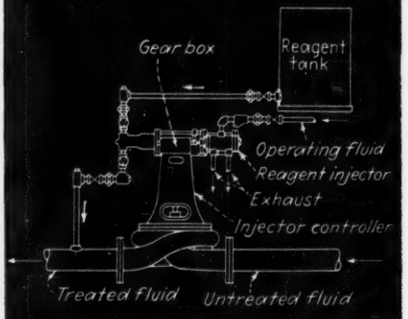


Fig. 30 — Application of injector shown in Fig. 29.

Already there have been described various methods of converting the action of a flow detecting element into flow readings or the operation of a controller. The inductance bridge, the electrical resistance unit, a motor integrator and mechanical counters have been covered. But there remains one of the most widely used of all the systems—that of the pneumatic meter. Figure 25 shows a pneumatic flow controller, complete from orifice plate to air-operated control valve in the flow line. A differential pressure across the orifice operates the float in the mercury U-tube meter body. Movement of this float actuates the pen which records the flow and the baffle which controls the air bleed. The distance of the baffle from the air bleed nozzle regulates the air pressure in the bellows that operates the relay air valve, and the opening of this relay valve controls the air pressure on the diaphragm valve. This pressure, opposed by a spring, regulates the opening of the control valve in the flow line and consequently the rate of flow in the line. The controller represented in Fig. 25 is a Taylor Instrument Cos. unit, but other pneu-

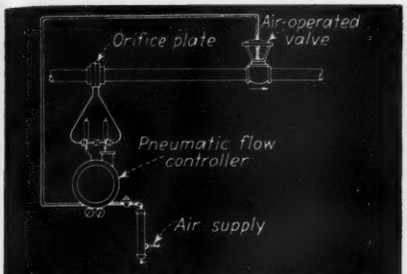


Fig. 31 — Simplest of all liquid flow control applications.

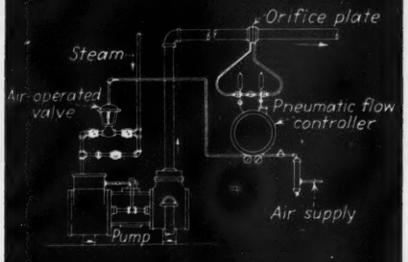


Fig. 32 — Controller regulates speed of reciprocating pump.

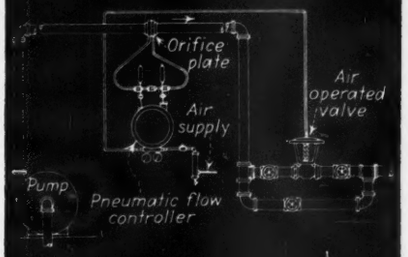


Fig. 33 — Method of flow control with centrifugal pump.

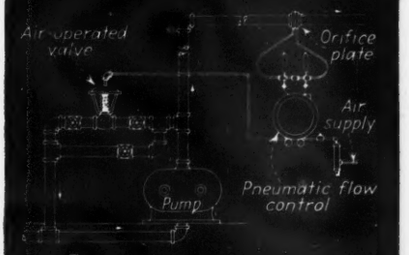


Fig. 34 — Bypass flow control with positive pump.

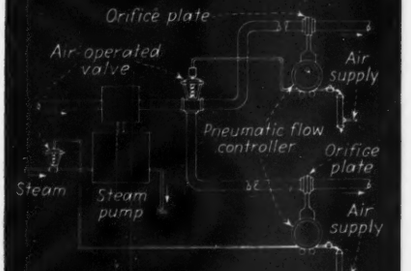


Fig. 35 — Controlling flow in two branches of a line.

matic controllers embody similar principles, though with some variation in design.

Except for the primary actuating elements, the orifice and the U-tube pressure differential meter, this pneumatic controller is identical with the type used in controlling temperature and pressure. (See Automatic Control of Batch-Process Temperature, FOOD INDUSTRIES, May, 1936, page 237; Automatic Control of Temperature in Continuous Processes, FOOD INDUSTRIES, August, 1936, page 403; and Automatic Control of Pressure, FOOD INDUSTRIES, September, 1937, page 549.) The electrical means of operating flow-controlling valves are also the same as described in these earlier articles. Almost any rate of flow detecting element can be caused to operate a switch which in turn will operate, either directly or through a relay, a solenoid valve or an electric motor-driven valve. The basic difference, then, between flow, pressure and temperature controllers lies in the sensitive element, or detector, which measures the magnitude of the variable under control.

In measuring flow, however, one step is sometimes required which is not necessary with pressure and temperature—the flow must be totalized. The rate of flow detectors of differential pressure and area meters indicate what the flow is at a particular instant. But for many applications it is total flow over a period of time that is desired. With positive displacement meters that operate mechanical counters, totalizing involves merely the mechanical addition of the number of cycles of operation of the piston or other displaced element. But with other meters the problem is not so simple. The mechanism for totalizing or integrating the flow with a differential pressure meter is shown in Fig. 26. This mechanism, as built by Bristol Co., mechanically computes the square root of the differential across the orifice every 15 seconds and totalizes the resulting values by means of a counter. And the square root total for a given time interval, when multiplied by the integrator constant, gives the total flow.

The integrator consists essentially of a telechron motor which operates a counter through a set of gears. These gears are engaged and disengaged by a magnet which is controlled by a mercury switch. When the switch is closed, the magnet engages the gears, and when the switch is open the gears are disengaged, so the telechron motor drives the counter only when the switch is closed. Now the mercury switch is operated by a magnet connected to a switch-operating rod which turns on pivots at the front of the instrument. This rod, the magnet, the switch and hence the counter gear clutch are operated by an arm positioned by the rate of flow. The arm is moved forward by a cam to open the mercury switch and stop the counter. This cam is rotated once every 15 seconds by a telechron motor.

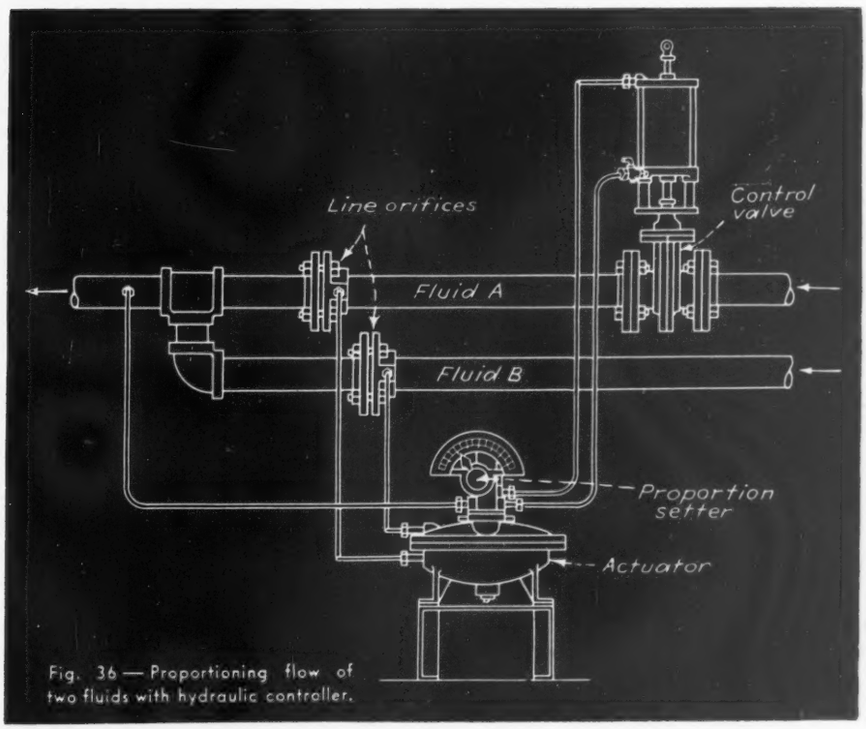


Fig. 36 — Proportioning flow of two fluids with hydraulic controller.

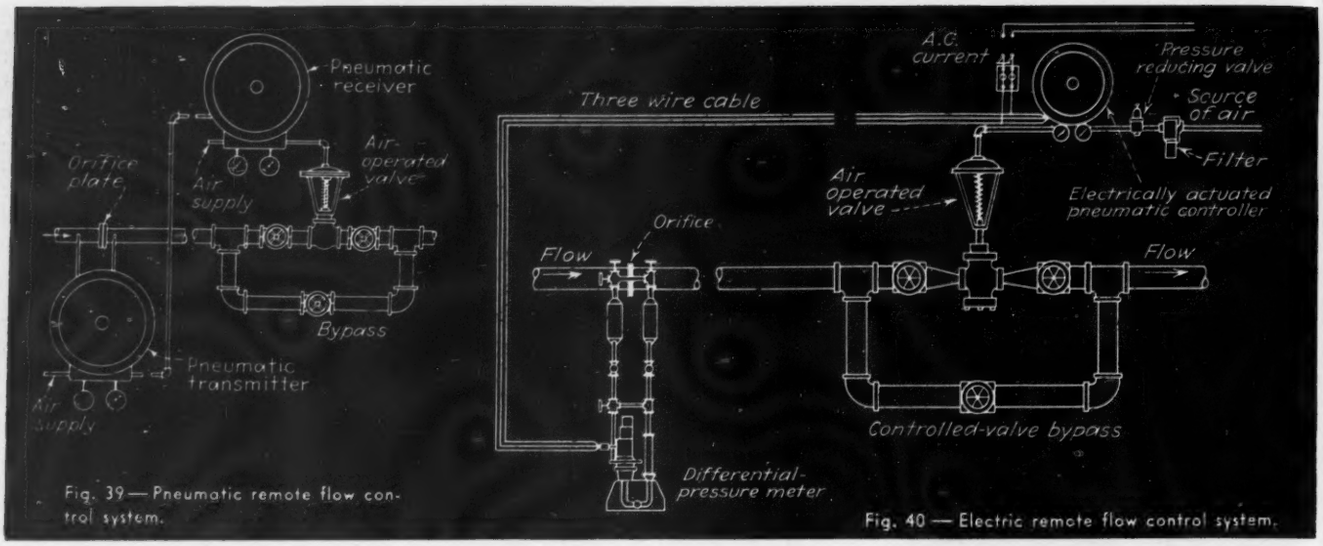


Fig. 39 — Pneumatic remote flow control system.

Fig. 40 — Electric remote flow control system.

The length of time the cam pushes the arm forward and hence the number of seconds out of the 15 which the counter is disengaged depends upon the position of the arm. If the rate of flow is low this arm will be close to the axis of the cam and will ride on the cam and be pused forward during a large portion of the revolution of the cam. But if the rate be high, the arm will ride only that small portion of the cam near the nose, and the length of time the counter is disengaged will be small. From this it may be seen that the length of time the counter operates is wholly dependent upon the rate of flow and the location of the arm positioned by the flow.

To make possible the recording on a chart of the rate of flow against time Bailey Meter Co. has developed a flow recorder for use with positive displacement meters. Ordinarily, these meters totalize flow over a period of time. This recorder (Fig. 27) is driven by the shaft of the displacement meter through a friction drive. Arm *CD* is pushed down by this drive until contact is made at M_t, the contact remaining closed until the constant speed cams driven by the telechron motors *T* reach their maximum throw. The cams are shaped so that the roller arm *MR* descends more rapidly than the arm *CD* moved by the friction drive, so that the latter is free to descend a distance proportional to the rate of flow through the displacement meter. In other words, the constant-speed cam at the receiver moves in synchronism with that at the transmitter so the two roller arms move up and down in unison. The position of the other contact arm at the receiver is that which it took on the previous cycle. Now, whether the pointer at the receiver remains where it is, moves up, or moves down depends upon whether contact is made simultaneously at M_r and M_t, or first at M_r or first at M_t. In the diagram, the receiver indicates 50 per cent flow capacity. Under this condition and with no change in the flow rate, contacts M_t and M_r will close simultaneously, both coils *A* and *B* of the reversing induction motor positioning the pointer will be short circuited, and no change is made in the reading of the receiver. Should the rate of flow drop to zero, the friction wheel would be stationary and arm *CD* would remain at a position corresponding to the maximum throw of the cam. This would cause M_r to close before M_t, and shading coil *B* alone would be short-circuited and the pointer would move to zero. If the rate of flow were increased above 50 per cent, *CD* would descend more rapidly and contact M_t would be made first, operating the reversing induction motor to increase the reading of the receiver.

This electrical flow transmitting circuit can be used also with a differential pressure meter. In this case arm *CD* is positioned by the float arm of the flow meter.

A simpler electrical transmitting circuit has been applied to a positive displacement meter by Buffalo Meter Co. A magneto is driven by the relatively fast moving units dial of the meter, the current generated by the magneto operating a meter.

International Filter Co. makes a hydraulically operated flow controller for regulating the flow through sand filters (Fig. 28). In this controller fluid is bypassed from the high pressure tap of a venturi tube in the flow line through an orifice in the actuator diaphragm. This produces a differential pressure on the diaphragm,

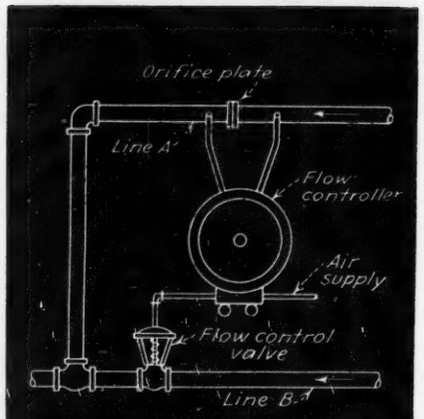


Fig. 38 — Using one controller to proportion flow.

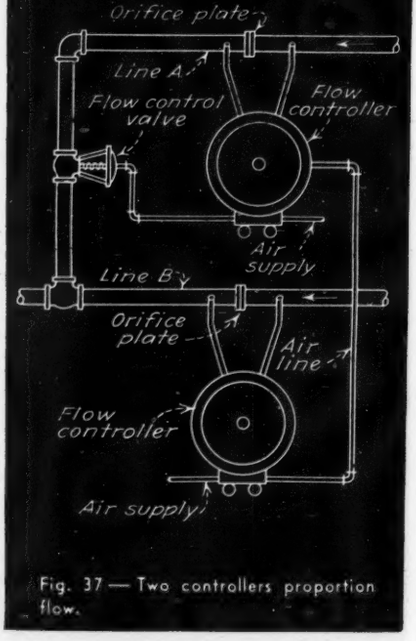


Fig. 37 — Two controllers proportion flow.

exerting a net upward force on it. If this upward force exceeds the weight on the diaphragm, the diaphragm moves upward. Now an increase in flow through the venturi increases the differential pressure on the diaphragm, moves it upward, raises the control pilot valve, admits water under pressure to the top of the control cylinder, moves the piston down, reduces the opening of the control valve and cuts the rate of flow. A decrease in the flow rate has the opposite effect. A variable orifice in the actuator permits the controller to be set for different rates of flow. This orifice varies the differential pressure on the actuator diaphragm.

With a flow control device built by Proportioneers, Inc., (Fig. 29) one fluid can be injected into another in quantities proportioned to the rate of flow of the second fluid. For example, chlorine may be injected into water as it flows through a pipe to treat it for use in food plant processing and cleaning operations. This device has a piston which injects the treating substance, as chlorine, into the flow line. This piston is driven by a second piston, as in a reciprocating steam pump. The speed of the driving piston, and the rate of injection, is controlled by a valve which in turn is controlled by a flow meter in the flow line. Thus the rate of injection is directly proportional to the rate of flow.

One way of applying this unit in treating a fluid flowing through a pipe line may be seen in Fig. 30. The untreated fluid passes through a metering unit which rotates at a speed proportional to the rate of flow. This meter controls the rate of operation of the reagent injector to give a treated fluid of constant proportions, regardless of rate of flow. Application of this flow proportioning equipment in canning operations will be discussed later.

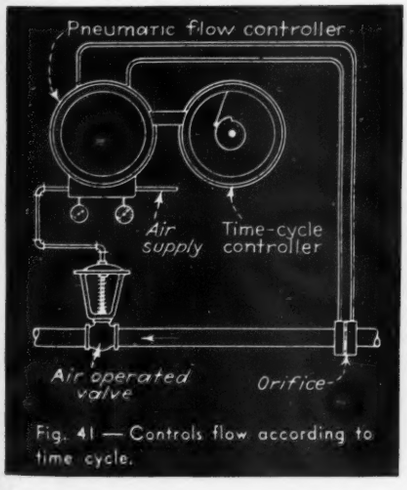


Fig. 41 — Controls flow according to time cycle.

What may be considered the simplest of all liquid flow control applications is that in which the valve is placed directly in the line of flow, as in the control of flow from a header. Figure 31 represents such an application, using an orifice type pneumatic flow controller and an air-operated diaphragm control valve.

How to control flow by regulating the speed of a reciprocating pump producing the flow is shown in Fig. 32. Here a controller, actuated by the pressure drop across an orifice in the pump discharge line, operates a valve in the steam supply line to the engine. Flow from all types of steam-driven pumps and fans can be controlled by regulating the steam supplied to the steam unit, whether reciprocating units or turbines. And flow from pumps or fans driven by a variable speed motor can be controlled by regulating the speed of the motor.

But sometimes other forms of control are to be preferred. And when the pump is driven by a constant-speed motor, other systems of control are necessary.

In the case of a centrifugal pump there is relatively little pressure build-up when a valve is completely closed in the discharge line. So it is permissible to throttle against the discharge, making flow control possible by the simple arrangement shown in Fig. 33. The controlling valve is downstream from the orifice.

Where flow is produced by a positive-displacement pump driven by a constant-speed motor, control of flow is attained by bypassing the flow from the discharge to the suction line (Fig. 34). The orifice plate is placed in the discharge line and the controlled valve in the bypass between the discharge and suction lines. This arrangement is necessary because there would be a dangerous pressure build up with a constant-speed positive displacement pump if a control valve were closed in the discharge line. Where such a pump is driven by a steam engine or turbine or by a variable speed motor, the control, of course, may be applied to the unit driving the pump.

An interesting flow control application is shown in Fig. 35. Here two controllers are utilized to maintain liquid flow rates in two branches of a line supplied by a pump, keeping the flow rate in each line at the desired value at all times. One controller governs the steam to the pump. The second operates a proportioning three-way valve to maintain the flow rate in one line. The remainder of the flow goes to the other line, and the instrument controlling the speed of the pump so controls the pump that the flow through the second line is constant. This application diagram and those of Figs. 31, 32, 33 and 34, are from the Foxboro Co.

A method of proportioning the two fluids flowing from two lines into a common line, the reverse of the application in Fig. 35, is shown in Fig. 36. Here the flow in line *A* is kept in direct proportion to that in line *B* by a controller of the type shown in Fig. 28. Orifices are located in both lines, with high pressure taps connected from the upstream sides of the orifices to the two sides of the diaphragm chamber or actuator. A low-pressure tap is taken off the common line, downstream from the orifices. The controlling valve is in line A. With this arrangement, if the flow in line *B* increases relative to that in line *A*, the diaphragm in the actuator moves downward and the control valve in line *A* is opened wider to increase the flow in line *A* proportionally to the increase in line *B*. An increase in line *A* relative to the flow in *B* would have the opposite effect. A proportioning system of this type might be used in mixing two fluids in continuous flow where the volumes of the two ingredients were not greatly different.

In proportioning flow with pneumatic and electric controllers, two instruments can be used (Fig. 37). An orifice is placed in each line. The orifice in line *A* operates a controller which positions a valve in line *A* according to the rate of flow in that line. The orifice in line *B* operates a second controller which is so connected to the line *A* controller as to vary its control point in proportion to the flow in line *B*. So if, say, flow increases in line *B*, the control point of the instrument on line *A* will be set up and then that controller will increase the flow in line *A* accordingly. A decrease in the flow in line *B* would have the opposite effect. If the flow in *B* remains constant, that in *A* will be held constant by the controller on that line.

Less accurate proportioning could be attained with one controller by placing the orifice plate in, say, line *A* and the control valve in line *B* (Fig. 38). Any change in rate of flow in *A*, then, would cause the controller to make a corresponding change in the flow in *B*.

Sometimes in flow-control applications it is necessary or desirable to locate the controlling valve a great distance from the point where the rate of flow is measured. In such

cases, remote transmission systems are used between the metering and the controlling units. Such a system for pneumatic controllers is shown in Fig. 39. A pneumatic transmitter, which is a standard flow controller, is connected by an air line to a pneumatic receiver, which is a type of instrument used in controlling pressure. Air pressure proportional to the rate of flow is applied to the receiver by the transmitter, actuating the former so that it operates the control valve in the flow line in accordance with variations in the rate of flow. Either or both the transmitter and receiver may be indicating or recording instruments.

Remote control valve operation utilizing an electric flow meter body of the type made by Brown (Fig. 20) and a pneumatic flow controller is represented in Fig. 40. The pneumatic controller is actuated by the inductance bridge principle, and it in turn operates the valve that controls the flow. This instrument may be indicating or recording.

A distance transmission system made by Tagliabue employs a pair of identical synchronous induction motors. The rotors of these motors are so connected electrically that movement of one causes a corresponding movement of the other. One of these motors is located at the point where the flow is measured, its rotor being operated by the metering instrument. The other motor is at the remote point where the flow rate is to be indicated, recorded or controlled, and movement of its rotor actuates the remote instrument. Remote control is possible also with all-electric controllers or with hydraulic controllers.

A remote transmission system used by Bristol employs a transmitter similar to the totalizer of Fig. 26 except that the counter is not included and the cam is of different shape. As in the totalizer, the cam rotates once every 15 seconds, pushing the pointer forward to operate an electric switch. The length of time the pointer rides the cam and the length of the electrical impulse depends upon the rate of flow and the position of the pointer. The receiver at the remote point is controlled by the length of the electrical impulse sent out by the transmitter over a two wire circuit. A magnet in the receiver, responding to the impulses, controls the operation of the recording element in moving the pen across the chart. The pen is positioned according to the relative duration of the impulses and intervals between them to record the rate of flow. The receiver could also be used to control flow.

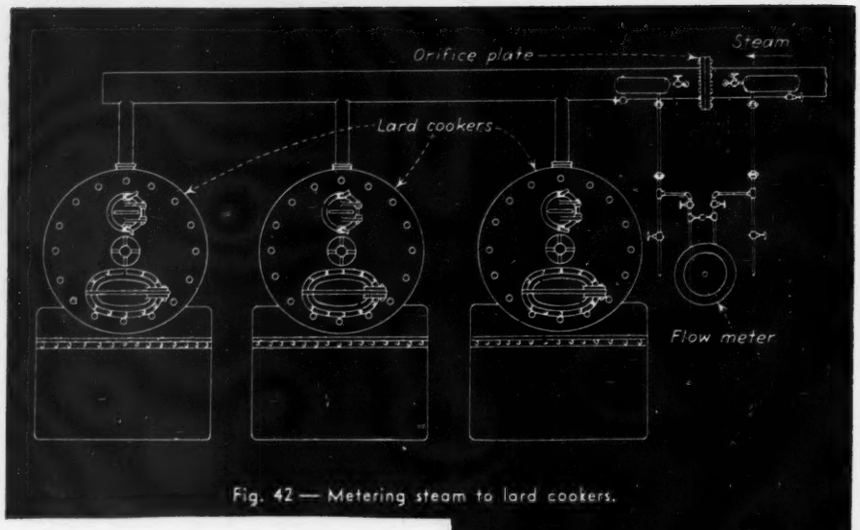


Fig. 42 — Metering steam to lard cookers.

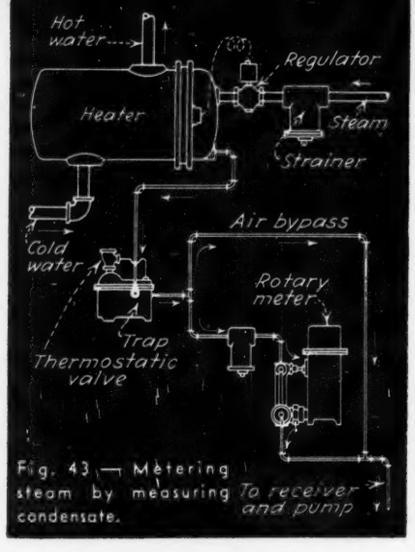


Fig. 43 — Metering steam by measuring condensate.

Variation of the rate of flow according to a definite time cycle is required in some processes. This is easily accomplished by an instrument of the type in Fig. 41, consisting of a combination flow controller and a time cycle controller. The latter utilizes a cam driven at constant speed by a telechron motor, the shape of the cam determining the rate of flow at any particular instant. Actuated by this cam, the time cycle controller in turn regulates the index or control point setting of the flow meter. Either pneumatic or electric instruments can be coordinated in this manner. In a complicated process, almost any number of controlled process variables, such as flow, level, temperature and pressure, may each be varied according to a time cycle in the sequence required by the process, thereby making the whole process automatic.

Fig. 42 shows the application of a steam flow meter to a battery of lard cookers in a meat plant. In this instance there is no control of flow, except as may be effected manually as dictated by steam consumption and cost records. The purpose of this installation, as employed by a large meat packer, is to make possible accurate determination of steam costs in the lard cooking department. It is installations of this type which are enabling food processors to locate points of excessive steam consumption and correct existing conditions with surprising savings in cost. The meter used in this case should be of the recording type to give a permanent record. Incidentally, the total flow over the period represented by the graph on a flow chart can be easily calculated with a planimeter designed for that purpose.

How to measure the steam consumption of a heater, dryer, cooker or similar unit by means of a low-cost rotary condensate meter is illustrated in Fig. 43. The condensed steam from the heater is passed through the meter on its way to the condensate receiver. Calibrated to read in pounds of condensate, the meter shows how many pounds of steam were consumed by the heater, since it takes a pound of steam to make a pound of condensate. The particular meter shown here is an American District Steam Co. unit (Fig. 7).

Three examples of proportioning the flow of chlorine to the flow of water being treated before used in canning plant operations are shown in Fig. 44. In two of these applications the chlorine is injected continuously into the flowing water by a unit of the type illustrated in Figs. 29 and 30. In the top diagram of Fig. 44, the water to be treated flows from a water main through a metering unit which controls the chlorine injector and then to a cooling canal where it cools cans of food which have just come out of the retort. In the center diagram,

the water, taken from an elevated tank, is treated in the same way and by the same equipment before being sprayed on cans of food to cool them. In both of these applications the pressure on the water line and hence the rate of flow varies, so a proportional chlorine feeder is needed to give the water a uniform dosage. But in the bottom diagram, the water is supplied by a pump driven by a constant speed electric motor, so a constant rate chlorine feeder is employed. This feeder consists of a plunger type injector driven at a constant rate by a motor.

It may not be obvious to those not engaged in the canning industry why it is necessary to chlorinate water which comes in contact with the outside of sealed cans of food. The reason is that if contaminated water is employed, some of the bacteria will get into some of the cans and cause spoilage. This has been proven by tests, and plants cooling and retorting with treated water have less loss from spoilage in the cans than do plants which do not treat the water.

Another industrial application of proportioning flow equipment is illustrated in Fig. 45. This represents a method of treating a food products oil with caustic before it passes to a centrifuge, devised by Proportioneers. Soy bean oil or cottonseed oil is pumped through an oil meter which controls a unit that sends out fluid impulses to an impulse motor actuating the control valve of a dummy pump which injects the caustic into the oil line. So the amount of causic pumped into the line is directly proportional to the rate at which oil flows through the line. This system will handle a large volume of treating fluid. In this application, the dummy pump control valve, and hence the rate of caustic injection, could also be regulated in proportion to the flow of oil by an orifice or venturi meter or other flow measuring unit.

Some of the other uses to which food processors are putting flow proportioning equipment is in treating the water used for washing oysters, for treating the water used in cleaning plant and equipment and for treating plant wastes. And the injecting device has been used to add sulphuric acid to beverages and beer to adjust the pH and speed up fermentation, for adding a cloudiness inhibitor to beer to make it chillproof, to add flavoring and coloring to carbonated water in the manufacture of beverages, this being done just ahead of the bottling machine, and to add pectin to fruit juices in jelly manufacture. In all

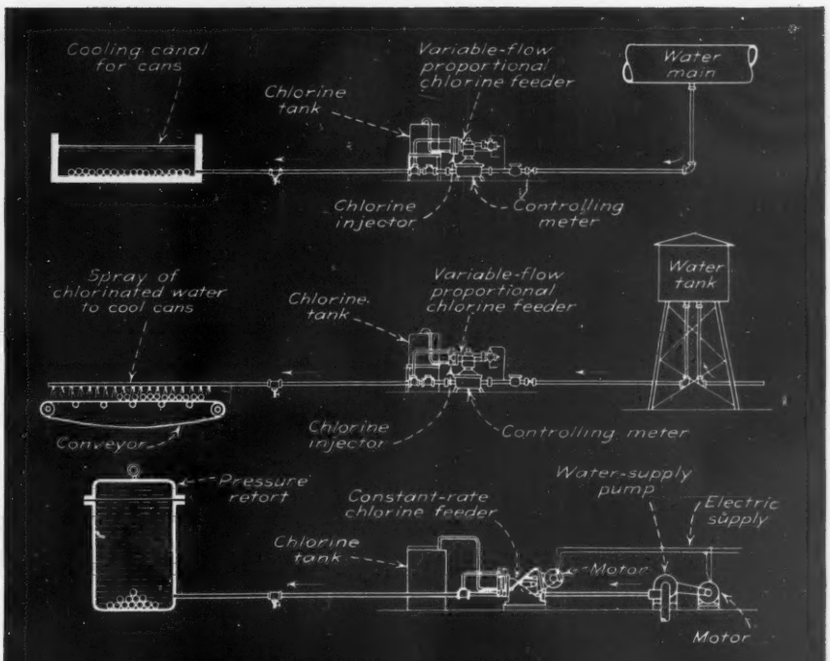


Fig. 44 — Controlling amount of chlorine added to flowing water.

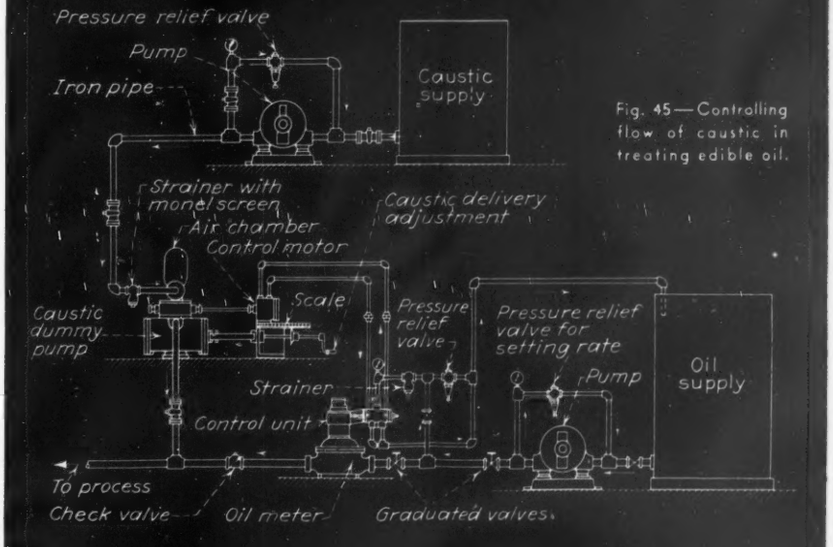


Fig. 45 — Controlling flow of caustic in treating edible oil.

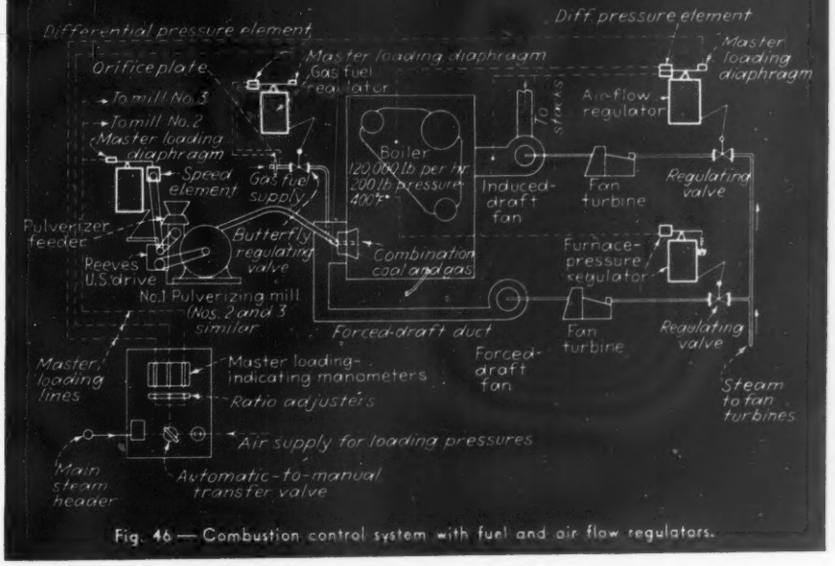


Fig. 46 — Combustion control system with fuel and air flow regulators.

these applications the fluid treated is in continuous flow.

Food manufacturers are using flow meters and controllers in their power plants as well as in processing operations. There are many instances where power generation costs have been cut substantially by more efficient combustion of fuel, closer regulation of the power plant with power demands, and the discovery of inefficient equipment. Figure 46 shows a complete combustion control system for a boiler fired with pulverized coal and with gas. A similar system would control an oil fired boiler. In this control system are included gas flow and air flow controllers. The gas flow regulator is actuated by differential pressure across an orifice in the gas supply line. This differential is applied to the two sides of a diaphragm which operates a beam that controls a Smoot hydraulic flow regulator. On the opposite end of this beam is a diaphragm connected to a master loading unit which permits central control of the combustion regulating system. The air flow regulator is similar to the one controlling the flow of the gas. But the pressure differential which actuates it is the difference between the air pressure in the boiler and that in the stack. To keep this differential, and hence the draft on the furnace, at the figure best for efficiency, the air flow regulator controls the steam to the turbine driving the induced draft fan in the stack. If the differential pressure, or draft drops, the turbine and fan speed up. If it rises too high, they slow down.

But many flow control applications are not so complicated as the last few shown. There are many flow control and metering uses to which the simple positive displacement meter is applied in food plants. Bakers for years have controlled or measured the amount of water put into a batch of dough in the mixer by passing the water through a postive displacement meter. Such an application may be seen in Fig. 47. This type of meter is particularly suited to controlling the fluid ingredients added to batch mixes in the food plant, whether the ingredients be water, sugar sirup, oil or what have you. When the baker is ready to run the water into his dough mixer, he sets the meter for the quantity of water desired in the batch. Then the water is run into the mixer through the meter, and when the desired quantity has passed through, the meter automatically closes a valve in the water line. In the particular meter shown here, a Baker Perkins unit, cut off is by a solenoid valve. Some meters of this type use a mechanically

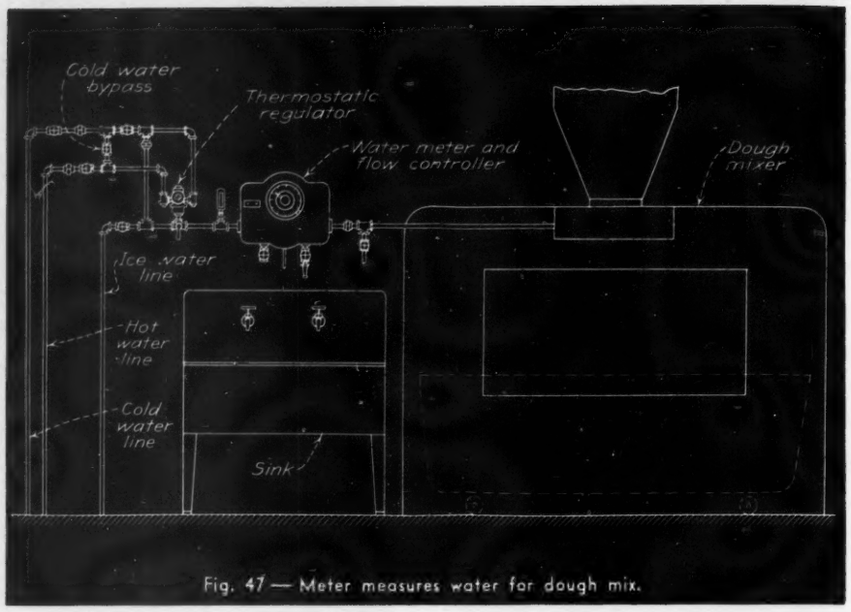


Fig. 47 — Meter measures water for dough mix.

operated valve mechanism. In this installation there is also employed a thermostatic mixing valve to deliver water to the batch at any desired temperature between 35 and 120 deg. F. One size of this meter will handle from 1 to 300 lb. of water; another size, 1 to 600 lb.

Most of the breweries of the country meter their beer for tax collection purposes through a positive displacement meter of the piston type, such as illustrated in Fig. 3. How this meter is installed in the line carrying beer from the cellar to the bottling house is illustrated in Fig. 48. At least one brewing plant controls the amount of sparge water run into the lauter tub by means of a positive displacement meter which rings a bell when the desired amount of water has been run into the tub. The same brewery has a portable positive displacement meter in its finishing cellar to check the amount of beer drawn from a tank or for mixing.

A can filler used to meter the correct amount of cottonseed oil, olive oil, corn oil and salad oil mixtures into containers employs a positive displacement meter of the piston type. And a similar unit is used to fill cans with wine and with sirups and other slightly viscous liquids. Chocolate manufacturers meter the amount of coca butter and chocolate liquor used in their operations with a positive displacement flow controller that cuts off when a predetermined amount of the liquid has passed through. And this type of meter also is used to measure cordials, extracts and fruit juices.

One type of positive displacement meter is even equipped with an adjustment which corrects for the temperature and specific gravity of the fluid being metered. And at least one is constructed to permit backflushing with water or a cleaning compound.

One of the popular uses for positive displacement meters is in filling barrels. A portable meter of the type made by Neptune Meter Co. is shown in Fig. 49 in position for metering a predetermined quantity of fluid from a vat into a barrel. This same meter has been used to meter beverages, ice cream mix, flavoring extracts, sugar sirups, vinegar, cider, corn sirups, fruit and tomato juices, molasses and vegetable oils. These applications were made for batch measurements, for proportioning the ingredients used in a product, for measuring product delivery and for cost accounting.

An interesting application of a differential pressure instrument is in controlling the flow of air in a yeast culture process. Another is in the blending of fruit juices. An unusual and unlooked for practical result of a flow meter installation on vacuum pans developed in a sugar refinery. Here it was discoverd that by watching the flow indicator the pan operator could tell when his process was reaching the finishing stage. It so happens that the steam demand varies with the state of the process.

A problem confronting the instrument user is when to employ what type of meter. Like most other processing problems, the solution depends upon the particular demands to be met, and the selection is really a job for a competent and experienced instrument engineer. Such engineers are in the employ of all the reputable in-

strument manufacturers, and their advice may be had for the asking.

But here are some points that may be considered. The positive displacement meter, the direct reading type of area meter and the shunt type velocity meter are the least costly of the flow meters, some of these being quite inexpensive. But the direct reading area meter does not control, totalize or record flow unless equipped with more expensive auxiliary apparatus. As for positive displacement meters, they are for the most part, but with exceptions, suitable for small rates of flow. They will totalize flow, but ordinarily do not indicate instantaneous rate of flow. They will control flow in batches by measuring off a predetermined amount of gallons or pounds, but they do not control continuous flow. The shunt velocity meter totalizes continuous flow but does not indicate instantaneous flow or control flow. The differential type of meter (orifice, venturi and flow nozzle) ordinarily will not meter as accurately as the positive displacement meter a flow varying over a wide range. And the differential units are considerably more expensive. But these instruments will indicate instantaneous rate of flow, will totalize flow and will record the flow rate. They will control continuous flow and proportion two or more fluids in continuous flow. They will handle large volumes and high pressures, and with an orifice of ½-in. diameter will meter or control as little as 500 gal. of water per hour at 50 lb. pressure or 1,000 lb. of steam per hour at 100 lb. pressure. This type of instrument has been used to handle much smaller rates of flow, but such applications are not common because of the high ratio of the cost of the instrument to the volume of flow metered. In some cases, such as in controlling the flow of the ingredients in manufacturing a food product, this cost may be justified. And in one instance a flow as small as 0.2 gal. a minute is being metered and controlled by a differential pressure instrument.

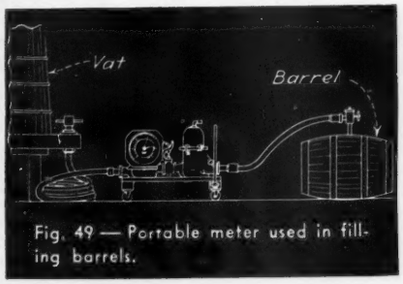


Fig. 49 — Portable meter used in filling barrels.

In some food plant applications, as for instance in metering milk, the sanitary features of the flow instrument are of paramount importance. And before buying instruments for such applications, it is well to find out from the manufacturer whether the instrument can be easily cleaned and sterilized. This is a problem that is not easily handled with most types of flow instruments. Perhaps the direct reading type of area meter, which consists of a corrosion resistant metal float inside a pyrex tube, comes as near as any flow meter to meeting the rigid sanitary requirements of the dairy plant. Some of the other meters, however, are so constructed that elements in contact with the fluid being metered can be cleaned by back flushing or by taking the instrument apart. One instrument manufacturer is studying a completely sanitary differential pressure meter for handling milk flow, and sooner or later such an instrument may be available.

Resistance to corrosion is another requirement that must be met by flow meters which are to handle many types of food products, such as, for example, vinegar. So the buyer of an instrument must pay careful attention to the type of material used in the construction of the meter and its ability to resist corrosion by the fluid to be handled. Otherwise, the instrument may soon become so badly corroded as to impair its accuracy or cause it to fail altogether. Slight corrosion will ruin a meter.

Yet another problem to be considered in using differential meters is selection of the proper sealing fluid to be placed in the pipes connecting the meter body with the flow line. This sealing fluid prevents contact of the fluid metered with the mercury in the meter body. In one installation metering cottonseed oil, water is used as the sealing liquid. One measuring a fatty acid is sealed with glycerine. All differential pressure meter bodies, of course, do not contain mercury. Some are of the bell type sealed with a fluid other than mercury. Metal bellows and helical pressure tubes can also be used as differential pressure detectors.

The relative accuracy of the different types of meters need not cause the food manufacturer much worry, so long as the type of meter selected is suited to the application. All types when properly applied are accurate enough for general food processing and cost accounting operations.

Another problem in metering a fluid containing solids in suspension with a differential pressure type of meter is the collection of sediment in the pressure connections to the flow meter body. In one application where beer mash is metered through a venturi tube, the pressure connections are flushed continuously by a small quantity of water supplied to each connecting pipe at tap pressure through small lines (Fig. 50). The amount of water added to the product in this instance is so small as not to be objectionable.

Where differential pressure meters are used in metering steam or gases condensable at atmospheric temperature, condensation chambers are connected to each of the legs of the

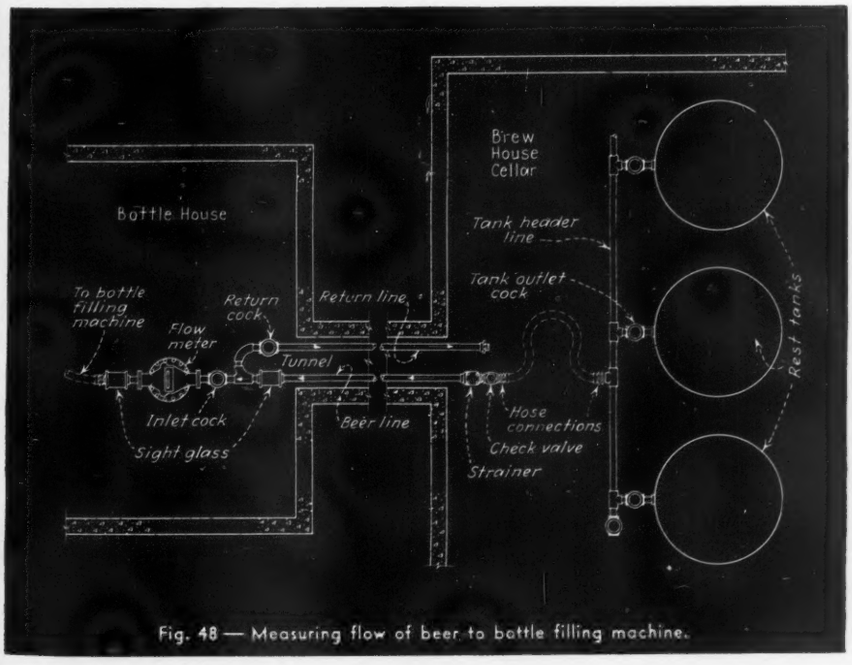


Fig. 48 — Measuring flow of beer to bottle filling machine.

U-tube at the point where they tap the flow line (Figs. 20 and 42). The purpose of this is to keep the U-tube legs filled with condensate to maintain a constant head on the mercury so as not to affect the pressure differential reading.

When installing differential pressure flow instruments, care must be taken to place the orifice plate, flow nozzle or venturi tube in a straight run of pipe far enough from a bend to avoid excessive turbulence in the fluid at the point of flow measurement. The instrument manufacturer's specifications should be followed in regard to this. Where the required length of straight run pipe is not attainable, sometimes the difficulty can be overcome by using straightening vanes in the pipe ahead of the orifice, flow nozzle or venturi to remove the turbulence.

A point to consider in controlling flow in a line, is that the pipe must have considerably greater cross sectional area than the full opening of the valve. Otherwise, at maximum flow rates the valve will exert too little effect in changing the resistance to flow in the line.

As for the type of controlling valve to use, this is the same as in controlling flow in temperature and pressure regulation applications. (See Automatic Control of Batch Process Temperature, Food Industries, May, 1936, page 237; Automatic Control of Temperature in Continuous Processes, Food Industries, August, 1936, page 403; Automatic Control of Pressure, Food Industries, September, 1937, page 549.) It is necessary, of course, in controlling flow to use a valve which will throttle between full open and full closed positions and which will change the flow rate by an amount proportional to the power applied in moving the valve stem.

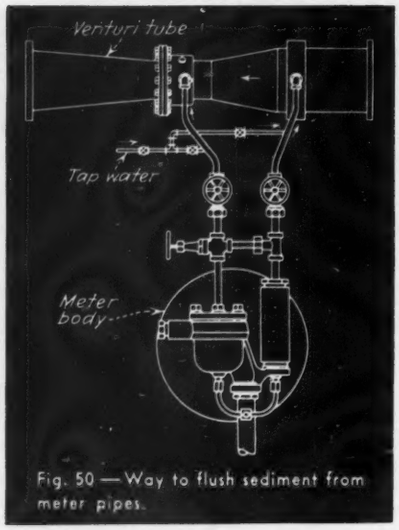


Fig. 50 — Way to flush sediment from meter pipes.

There are many uses to which flow instruments are profitably put in the food industries. And there is a flow meter and controller for to meet every purpose. If this article has succeeded in suggesting to the food manufacturer ways in which he can improve his operations or cuts his costs through the use of this type of equipment it will have accomplished one of its purposes. If it has acquainted him with the wide variety of equipment from which he may select something that meets his requirements, it will have served a second purpose. And if it has covered the important factors involved in selecting and using flow instruments its final purpose will have been accomplished.

But regardless of how much general information the food manufacturer may obtain about flow instruments, he should consult the engineers of the companies that manufacture instruments for a satisfactory solution of his metering and control problems. The knowledge involved in instrumentation is so specialized that the advice of the professional instrument engineer is needed.

It was not the aim of this article to rank one type of instrument above another, or one manufacturer above another. And if the name of a flow instrument manufacturer does not appear in this article, it is no reflection on the manufacturer or his product. We have simply selected types of instruments that would show what was available to the user, and in connection with the type we have mentioned the name of the particular manufacturer whose instrument was illustrated by a drawing or described in the text.

Liquid Level Later

INSTRUMENTS for measuring and controlling liquid level were to have been discussed in this issue of Food Industries, along with those for measuring and controlling flow. But as it turned out, the subject of flow instruments required more extensive treatment than had been anticipated, so the article on liquid level instruments will be published in a later issue.

Other types of meters and controls which have practical application in the food industries will also be covered in future issues. Among these are instruments for measuring or controlling pH, turbidity, density, color, moisture content and register. It is the intention to provide readers of Food Industries with information on the instruments available for measuring and controlling all of the important variable factors involved in food processing operations. For it is by better control of these variables that progress will be made in food manufacturing.